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REWARD

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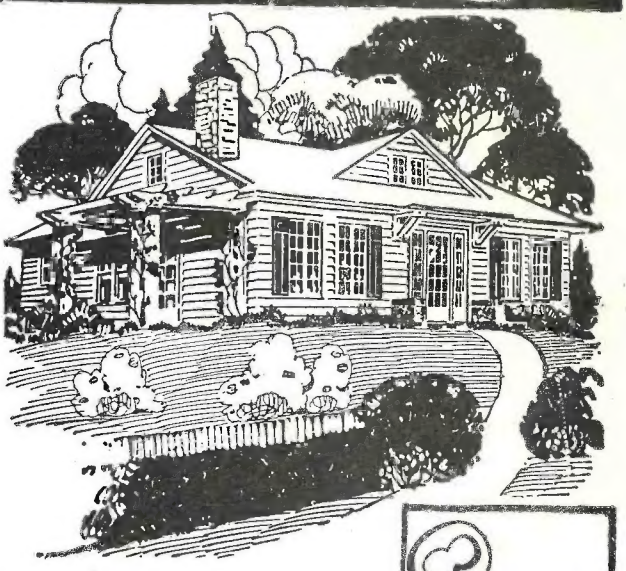
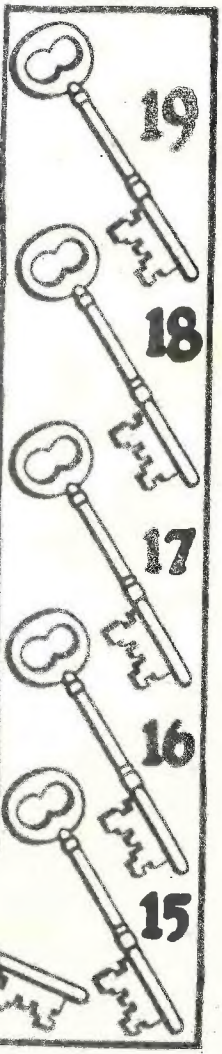
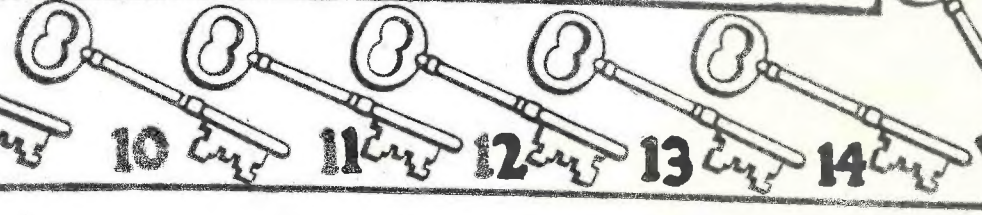


There are 19 house keys pictured here. To be sure, they all look alike, but, examine them closely. 18 of them are exactly alike, but "ONE," and only one, is different. See if you can find the different one.





CLUES This difference may be in the size, shape, or even in the notches. So study each key carefully and if you can find the **"ONE"** key that is different from all the others, send the number of it **AT ONCE.** You may become the winner of this house, lot, and garage, or **$4,500.00 CASH** without one cent of cost to you.

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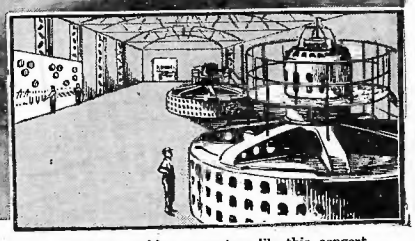

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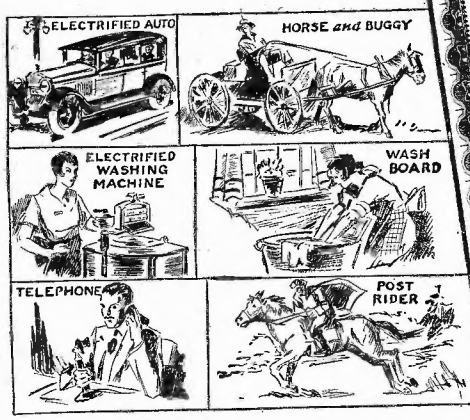

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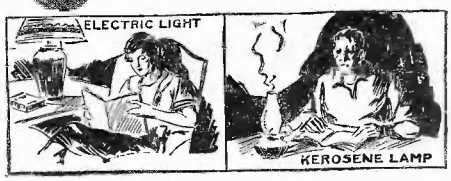

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Vol. XVI
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EDITORIAL, ADVERTISING AND GENERAL OFFICES:
230 Fifth Avenue, New York City

Published by Experimenter Publishing Company, Inc. H. Gernsback, Pres.; S. Gernsback, Vice-Pres. and Treas.; C. E. Rosenfelt, Sec'y.

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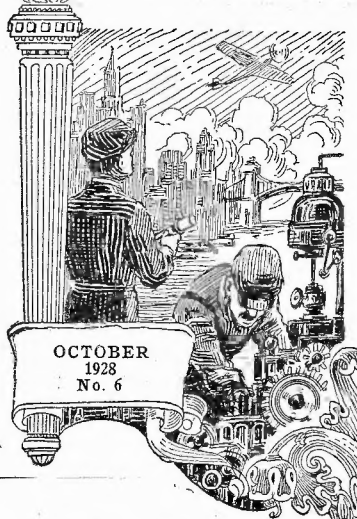

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Building Aircraft Engines

Various interesting details in the manufacture of the famous air-cooled engine used by Colonel Lindbergh will be described and illustrated.

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A new application of the home movie camera will be described and illustrated with hints and instructions on how to carry out the work.

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The newest developments in television and radio movies will be discussed in popular style with pictures.

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This well illustrated article shows the newest advances of science in helping the mother to raise babies.

Saving Coal!

One of the best ways to save coal this coming winter is to properly insulate your house. Don't miss this very valuable article, as it will mean a big saving in your coal bill.

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SCIENCE AND INVENTION is published on the 10th of each month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries, $3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25c each. All communications and contributions to this journal should be addressed to Editor, SCIENCE AND INVENTION, 230 Fifth Ave., New York City, N. Y. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. SCIENCE AND INVENTION Monthly. Entered as second-class matter May 10, 1924, at the Post Office at New York, N. Y., under the act of March 3, 1879. Additional entry at Dunellen, N. J. and San Francisco, Calif. Title Registered at the Patent Office.

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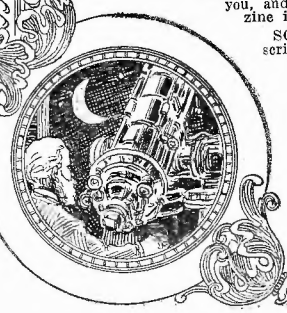

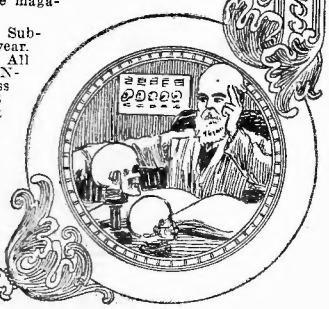

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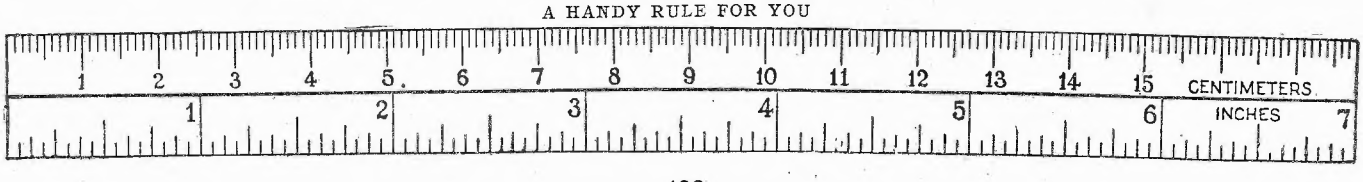

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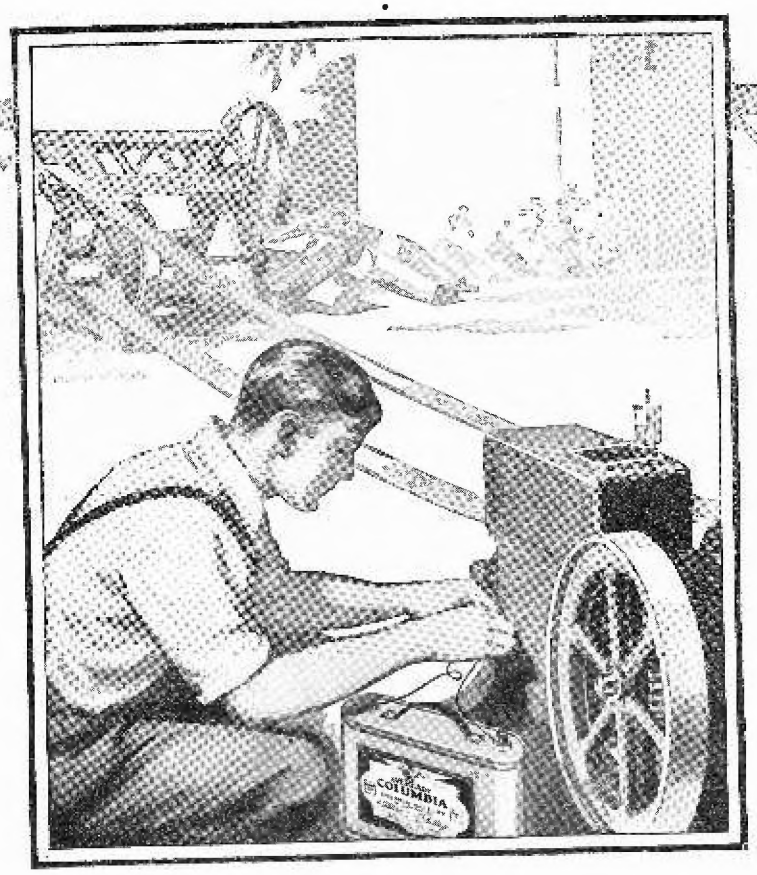

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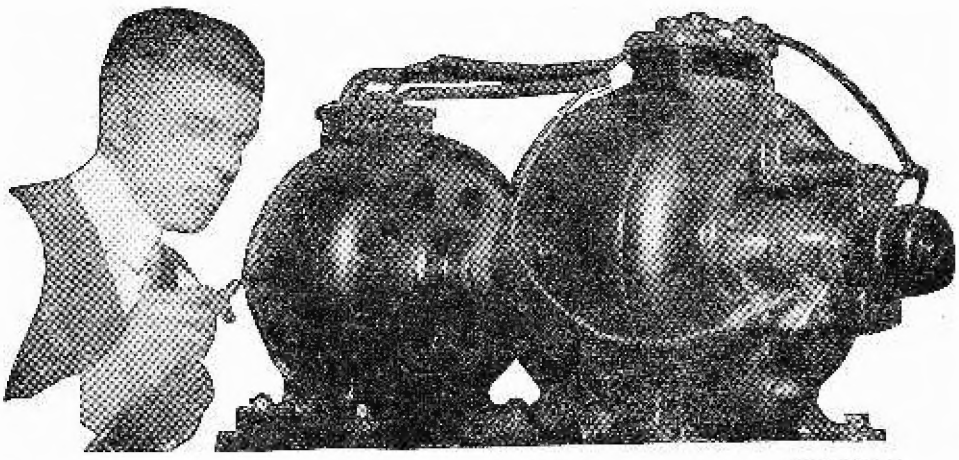

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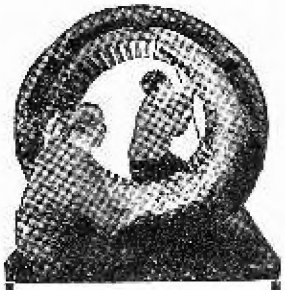

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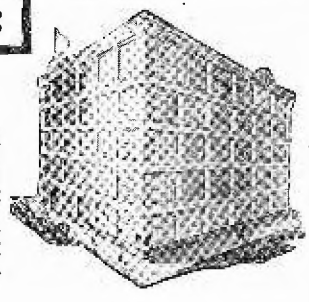

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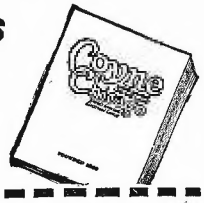

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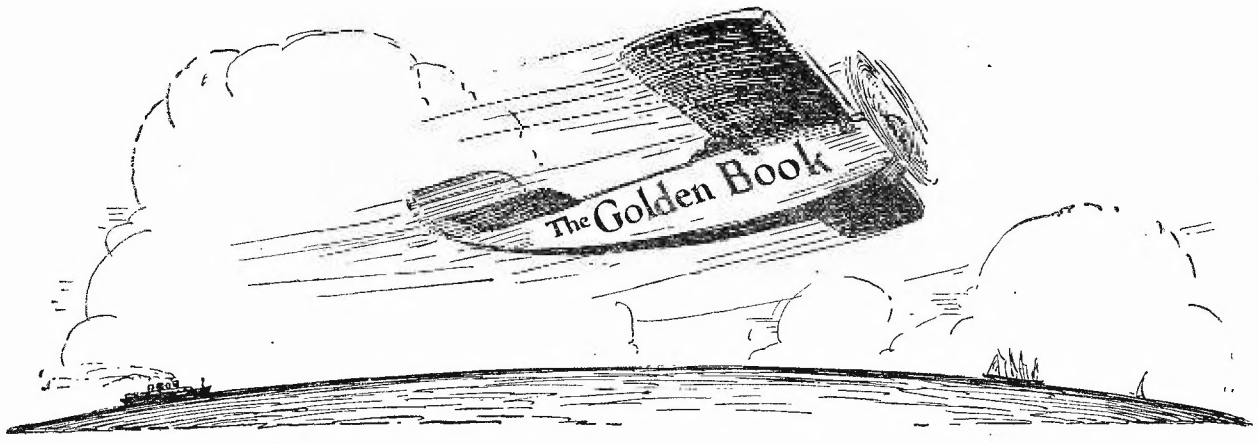

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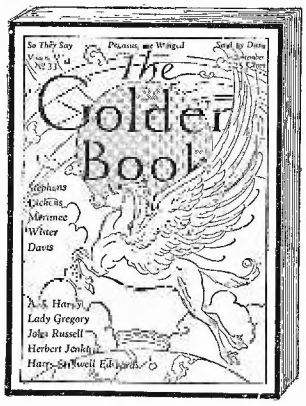

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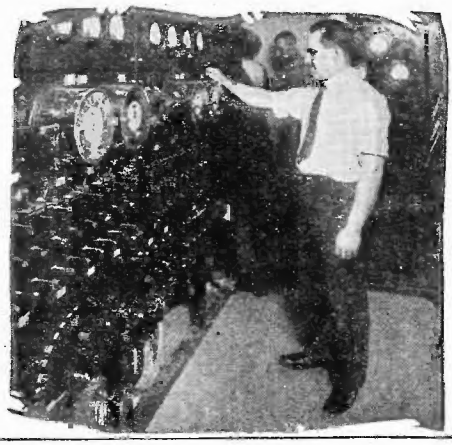

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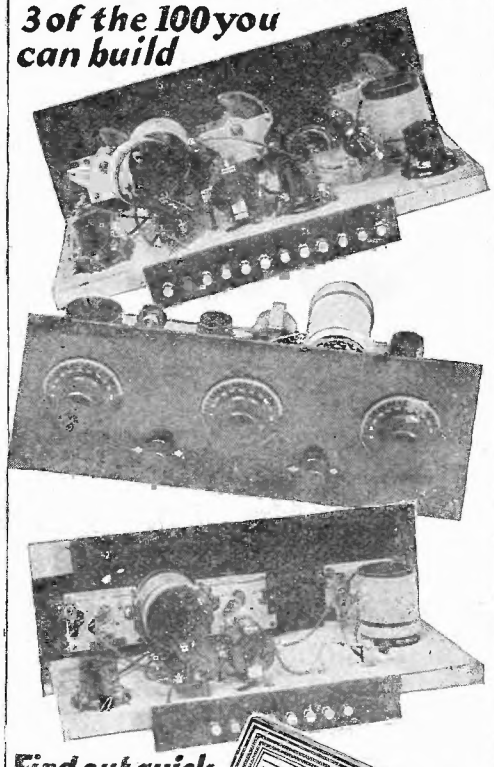

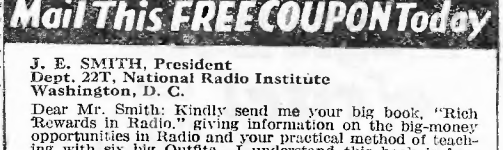

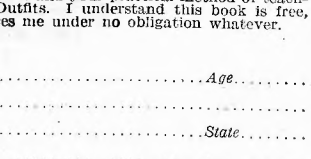

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Volume XVI
Whole No. 186

Science and Invention

October, 1928
No. 6

HUGO GERNSBACK, *Editor-in-Chief*
H. WINFIELD SECOR, *Managing Editor*
DR. T. O'CONOR SLOANE, PH.D., *Associate Editor*
Editorial and General Offices - - - - - - - - 230 Fifth Avenue, New York

"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - - - - - - - - - *HUXLEY*

FACTS ON TELEVISION

By HUGO GERNSBACK

NOW that television has actually arrived, and inasmuch as a number of radio stations are already broadcasting images of living subjects by television, a few pertinent facts concerning the new art may not be amiss.

There is still a good deal of confusion in the public's mind as to what television really is. This is primarily due to the fact that such words as radio movies, radiovision and radio pictures all confuse the popular understanding of television.

Not so long ago, in order to clear the issue, I gave the following definition:

"TELEVISION MEANS INSTANTANEOUS SIGHT AT A DISTANCE"

Anything that this definition does not cover is not true television.

Certain stations are now broadcasting radio photographs. This is a process where a photograph is first taken, then developed, mounted on a cylinder and sent piecemeal over the air, as we may express it, by radio impulses. At the receiving end we have a corresponding cylinder, with sensitized paper attached, and after a period varying from three to seven minutes, we receive a photograph. That is telephotography, but it is NOT television.

Then there is another process whereby at the sending or transmitting station a reel of motion picture film is run through a machine, and at the receiving end a similar motion picture is received on a screen, usually made of ground glass. This brings us a step nearer to television, but it is, of course, not true television, because according to the definition it is not sight at a distance. It is receiving motion pictures that were made at a previous time, long before the broadcasting, and these motion pictures are then transmitted and thus received as motion pictures.

Paralleling this, we can take a phonograph record, which had been made months ago, and play it in a broadcast studio. You will receive the sound of the phonograph record, but you will know that it is "canned" music. Transmitting motion pictures by radio is, therefore, the transmission of canned "sight," which is analogous to "canned" music.

True television, to restate the case once more, is "Instantaneous sight at a distance." You therefore see what is going on in the distant radio studio, instantaneously, at the time the event is taking place. If someone in the studio steps before the television transmitter and moves his hand or smokes a cigarette and you receive the image of this procedure instantaneously at the time the event is taking place, on your television receiver, we then have real television.

I have gone to some lengths to explain this, because there is still a good deal of confusion on the subject at the present time.

It is true, that television is, as yet, a crude art, with no refinements. For the next few months, experimenters who build their own television receivers, will be glad if they can receive the face of a man or a woman so that they can distinguish the individual features of a person.

At the receiving end, we usually have a disc about two feet in diameter which disc is spun at an unvarying speed by means of an electric motor. The disc has a number of holes in a spiral line, and behind the disc there is a neon lamp. This neon lamp is connected to the loud speaker terminals of your radio set; if you are sufficiently near a broadcast station, say not more than twenty-five miles distant, and if the signals received are fairly strong, you will then see a true image appearing in the plane of the disc by looking through the holes in the disc. The image at the present time, due to the glow of the neon tube, is of a salmon-pink-red hue. The image is rather small, usually about one and one-half inches high by one inch wide, or thereabouts. This image can be enlarged somewhat by means of a lens, but if you try to enlarge it unduly, it becomes very coarse and almost indistinguishable. Also the image becomes much dimmer when enlarged too much.

Many people want to know why a large image cannot be received by television at the present time. The explanation of this is that the intensity of the light of a neon tube is not sufficient to give the illumination required to throw it upon a large screen and thus project a bigger image. But this is only a temporary handicap. Sooner or later, this problem will be solved, most likely, during the next six months.

An important point about television in its present stage is, that the public should understand, that it will be quite a while before complete television sets will be sold. Many so-called kits for those experimenters who want to make their own, will, of course, be obtainable, but such kits are only for those fairly well versed in radio, electricity, optics and general science. The greatest difficulty, at the present time, in television is the synchronizing feature. If, at the transmitter, the scanning disc has 48 holes and spins at exactly 600 revolutions per minute, you must have exactly the same elements in your receiver. Moreover, the speed at the receiver must be absolutely exact, and if hole No. 1 passes a certain object point at the transmitter at a given fraction of a second, the same hole in the same position must also pass the same spot and at the same instant at the receiver. If that is not the case, the discs, that is the one at the transmitter and the one at the receiver, will not be in step, and they will not be what the engineer calls "in isochronism."

A great deal of attention is given at the present time, by engineers, to get automatic synchronization, but this stage is as yet not reached. That means, of course, that television is not ripe for the public. It will be some time before you can step over to your radio, press a button, turn a switch, and receive perfect television images, without having to do anything at all.

If you remember the hectic radio boom days of 1921, you will possibly recall when you frequently had to hang on to the dials with both your hands, in order to get any intelligent radio reception; and even then, the reception usually was accompanied by numerous squeaks, howls and squeals. Parallel conditions prevail in television today.

This condition is greatly aggravated by the fact that the eye is far more sensitive to variations than the ear. A little static and other interfering noises in your radio set are discounted by the ear, and are no longer heard. Yet, in television, the same static and interferences show up as coarse streaks in the image and often spoil the received picture.

But all of these things are only temporary. The main and important fact is that television has actually arrived and that hundreds and thousands of qualified amateurs and radio experts will be experimenting with television during the next few months.

It is felt, that the present system whereby we require a rotating disc and a motor at the receiving end is only part of a transitory stage. During the next two years, we will have entirely different methods and most likely will not have any moving discs at all, but the receiving image will be built up in some other and less cumbersome manner.

Also, at the present time (referring to the usual broadcast band between 200 meters and 545 meters) we cannot receive simultaneously sound and vision. The reason for this is that both television and sound are received as sound. The usual broadcast reception is had in the usual manner, but the television impulses are received in a sort of high pitched screaming sound, that rises up and down, and is not at all pleasant to your ears. So we have the effect where the usual broadcast sounds are received first and then the radio announcer will say, "We shall now televise the face of our next singer. Mr. or Miss So-and-So." Then for a short space, or from three to ten seconds, you receive the aforementioned high pitched screaming sound in your loud speaker. At the same time, the image will be seen through your television disc. At the end of the television broadcast, the usual sound broadcast goes on again. Simultaneous broadcast of sound and television is, as yet, not in sight, but sooner or later it will be developed. The important thing is that a beginning has been made, and that television has actually arrived, although, for the present time, it is only for the experimenter.

Mr. Hugo Gernsback speaks every Tuesday at 9.30 P. M. from Stations WRNY (326 meters) and 2XAL (30.91 meters) on various scientific subjects.

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The Secrets of

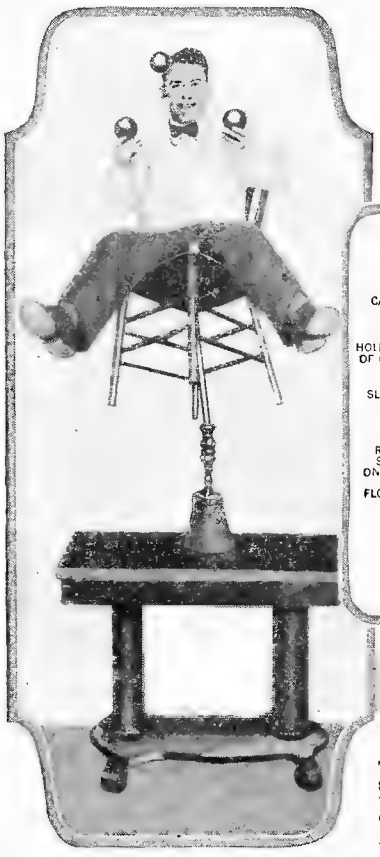
How Mechanical Devices Help

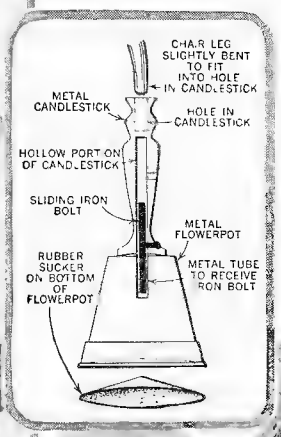
By SAM

ON the stage was a table. And on the table was a flower pot. And on the flower pot was a candlestick. And on the candlestick was a chair. And on the chair was a man. And the man was juggling three oranges!

Effects in balancing like that are a wee bit beyond the ken of the average spectator; so, consequently, he applauds vigorously and goes away with the feeling that he has gazed upon something that smacks of unparalleled skill.

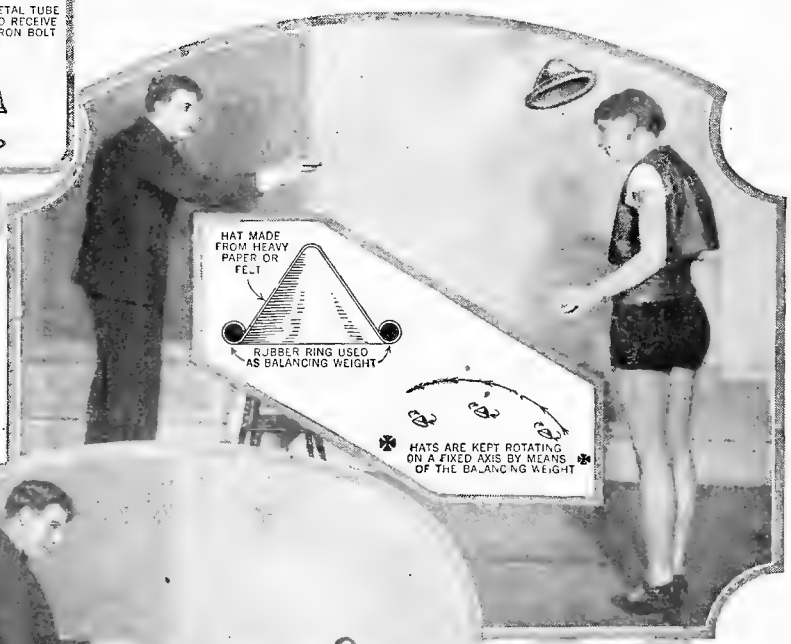
But . . . there are juggling effects and juggling effects; some only acquired after long years of patient practice; others which can be performed by any athletic man or woman equipped with the necessary

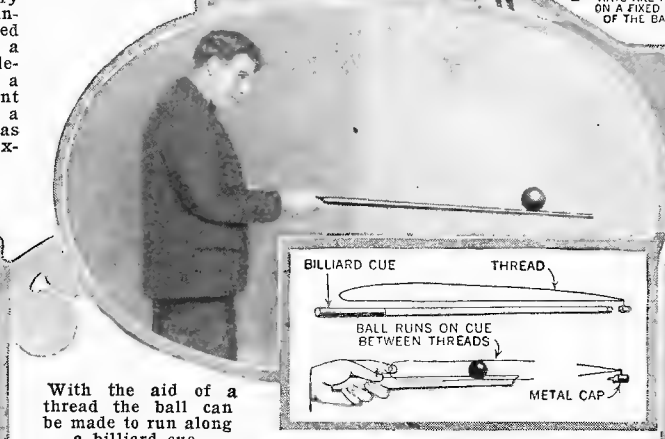



CHAIR LEG SLIGHTLY BENT TO FIT INTO HOLE IN CANDLESTICK
METAL CANDLESTICK
HOLE IN CANDLESTICK
HOLLOW PORTION OF CANDLESTICK
SLIDING IRON BOLT
METAL FLOWERPOT
RUBBER SUCKER ON BOTTOM OF FLOWERPOT
METAL TUBE TO RECEIVE IRON BOLT

The flower pot sticks to the table, and the candlestick to the flower pot by methods shown.

Above we see what seems to be a very clever stunt in juggling and in maintaining balance. The juggler is seen poised in a rather precarious position on a chair, one leg of which rests on a candlestick and the candlestick stands on a flower pot on top of the table. A stunt of this nature generally carries quite a bit of applause with it, yet it is not as difficult as it seems. The diagram explains how it is done.


HAT MADE FROM HEAVY PAPER OR FELT
RUBBER RING USED AS BALANCING WEIGHT
HATS ARE KEPT ROTATING ON A FIXED AXIS BY MEANS OF THE BALANCING WEIGHT

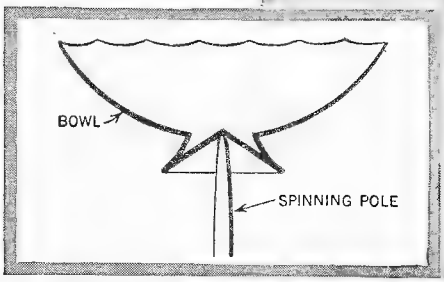


With the aid of a thread the ball can be made to run along a billiard cue.

Many ingenious and apparently difficult feats in juggling are accomplished through the expedient of trickery. For example, it would be absolutely impossible for a juggler to balance a ball on a billiard cue as shown in the photograph immediately above. Yet this becomes an easy stunt if recourse is had to the aid given by a thin piece of thread fixed to the cue at the top and held by the fingers as the diagram immediately under the photograph shows.

Bolts are frequently employed to rivet individual pieces of apparatus together or even to hold chairs together after they are placed one on top of the other to produce an effect of recklessness. When these bolts are shot into place the entire structures become nearly as rigid as a steel tower. The juggler, therefore, need have no greater fear than he would have were he climbing an ordinary ladder. On these pages we show but a few of the many subterfuges employed.

At the left we see a bowl full of water being spun on the end of a billiard cue. At the termination of the stunt, the bowl is dropped, as is indicated in the photo at the right, at which time it will be found empty. The water has evidently disappeared. It is not generally known that this water is made to travel into the billiard cue used to spin the bowl, through an opening at the bottom.



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Stage Juggling

To Produce Illusions of Skill

BROWN

and all-important apparatus. Such an effect is this table—flower pot—candlestick—chair balance. It hinges, as does many another effect of a juggling nature, on the use of concealed apparatus.

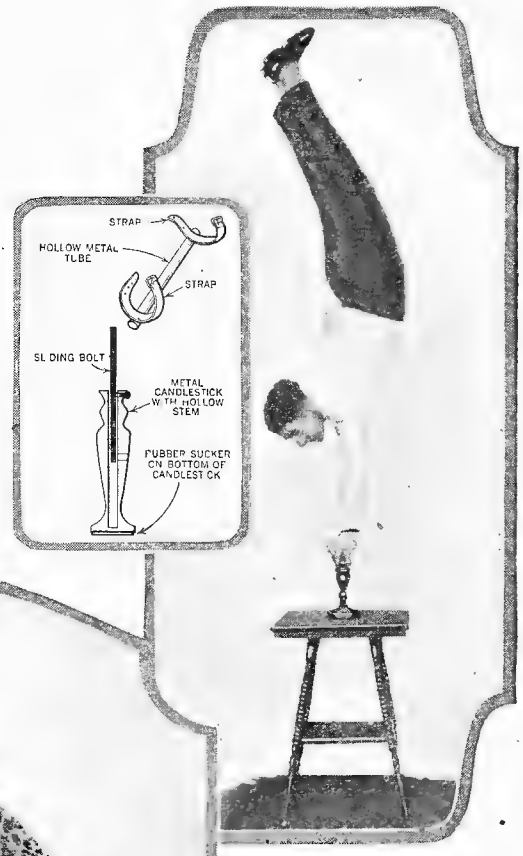
In this instance, the table is unprepared. The mouth of the flower pot, however, is entirely covered with a large rubber sucker, which, when pressed against the wooden table top, adheres with extreme rigidity. The candlestick contains a concealed iron rod, as illustrated by the first photograph, down into a metal recess in the flower pot, and thereby welds the two firmly together. The last item, the chair, is an ordinary chair with the possible exception that one of its rear legs has been curved slightly so as to allow a better fitting into the hollow top of the candlestick.

So . . . it's not so hard after all! The flower pot is fastened to the table, the candlestick is bolted to the flower pot, and the chair is wedged firmly into the candlestick. The performer then mounts his "precarious perch" where he "cascades" and "showers" three oranges, balances two or three spinning plates, and does various other legitimate bits of juggery.

Another "awe-inspiring" effect of a similar nature is the Chair Balance. On looking at the photograph of this, one may be pardoned for saying, "It's a good trick if he does it, but a better one if he don't," for it is obvious that the slightest slip-up would result in the classical "grand flop."

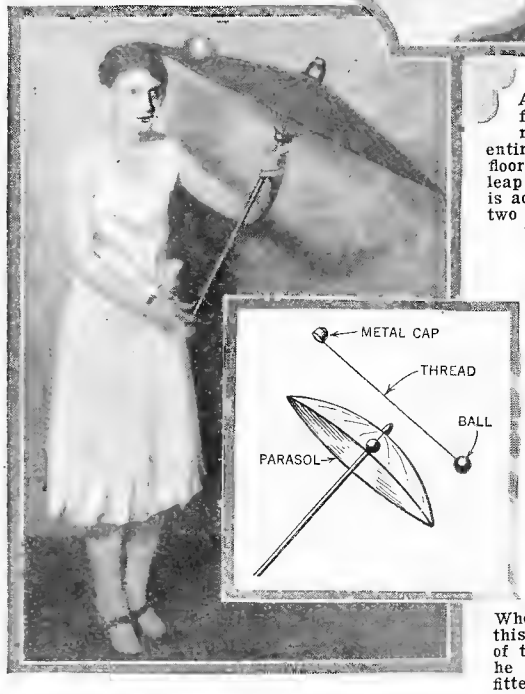
But . . . no danger! As impossible as the feat appears, it can be readily executed by even the most nervous performer, as shown by the accompanying diagram. Inside the hind legs of three of the chairs are concealed bolts which can be shot up or down with a single

(*Continued on page* 568)

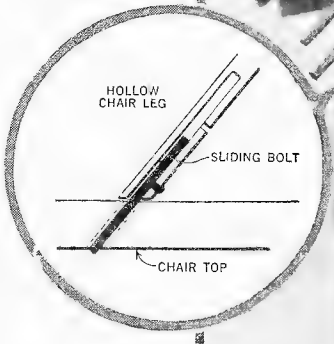


A one-hand stand on the end of a candlestick is simple when a bolt from the candlestick runs into a tube attached to the arm.

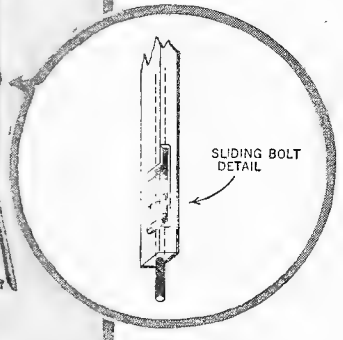
At the end of a performance two leopard rugs, which during the entire act have been on the floor of the stage suddenly leap toward the juggler. This is accomplished by the aid of two threads, accentuated in the photograph above.



Who couldn't keep a chair in this tilted position on the top of the pyramid of others when he receives the aid of bolts fitted in the legs of the chairs.



At the left we see quite an accomplishment in juggling which becomes a trick of no great intrinsic value when faking is resorted to. Here a chair is mounted on a table, and this holds two other chairs, placed leg to leg, as the photograph indicates. A man seats himself on the top and then balances himself. Two sliding bolts in the legs of the chair at the top and sliding bolts on all four legs of the chair at the point indicated by the second arrow relieves the danger.



When pieces of apparatus are joined together by bolts it is no more difficult to produce a seemingly difficult effect than it would be to do this on the safety of a mat.

Here is one effect that can be performed legitimately. We see the young lady balancing a ball on a rapidly moving parasol. She estimates the position of the ball by the shadow it leaves. In trick juggling or in the juggling performed by certain artists who would rather produce effects than practice for years to master tricks of skill, the ball itself is attached to the end of the thread, the opposite end of which is fitted to a metal cap which rests on the tip of the parasol. It will thus be observed that the parasol can be rotated rapidly and the ball balanced without fear of losing it yet the inference of skill is produced.

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SAFETY FIRST

Good Housekeeping Promotes Health and

By RHYS G.

Above we see a most frequent cause of accidents. Last year's statistics show that 5,400 persons were burned or scalded and 1,500 were victims of fires or explosions. This data was compiled by the National Safety Council of the United States.

Dangerous accidents and possibly death may be avoided by placing a wooden rail across the window frame, as shown above.

STRIKING, tragic and certainly convincing evidence of a great national need for housewives and others to practice safety first in the home is seen in a digest of last year's accident facts by the National Safety Council, with headquarters in Chicago.

This survey shows that accidental deaths in the United States increased from 79,305 in 1911, to an estimated 95,496 last year (1927), a difference of approximately 16,000. It shows that the number of fatal accidents in the home last year was 24,000 and it estimated that the number of persons injured was 5,000,000. Automobile accidents were revealed to be the only class that caused more deaths than falls, burns, scalds, fires, and other mishaps in the home. It shows that, probably as a consequence of almost a score of years of intensive safety-first education in industry, the number of industrial accidents, fatal and non-fatal, has been steadily decreasing and is now less than the number of home accidents.

Analysis of statistics reveals that accidents are the third most important cause of deaths of men, whereas they are seventh on the list of causes of deaths of women. The figures show that of the 24,000 men, women and children who died last year as a result of accidents in the home, 8,000 fell, 5,400 were burned or scalded, 1,500 were victims of fires or explosions, 450 were killed by electricity, 3,600 were overcome by gas or suffocated, 2,000 were poisoned, 600 were shot by firearms, and the remaining 2,450 were victims of other causes. Most of these deaths were avoidable; in fact, the National Safety Council points out that 90 per cent of accidents can be avoided, if proper alertness is practiced.

The statistics show that more than one-half of all deaths by falls are to persons over 55 years of age. They disclose that more than one-half of all deaths by burns are to children under ten years of age. They announce that the most of the home accidents occur in homes of the poorly housed.

To help promote health and happiness by pointing out how these home accidents can be avoided, this article will tell some of the things to do and some of the things not to do around the home to practice safety first. Good housekeeping is perhaps the chief contribution to safety in the home.

HOW TO PREVENT ACCIDENTS

IN the first place, loose rugs on a slippery floor are a hazard and they are doubly so if they are located near the head of a stairway. Rugs should be made secure. Stairways should be lighted. They should have railings and these railings should be firm. This is particularly important if they lead to a dark basement. The porch should have a railing, too. So should the front steps. The children should not slide down the bannister and they should not leave marbles and tops and other toys on the stairs, because a person might trip over them and suffer a serious fall. Adults should be watchful, too, not to clutter up stairs with things that might cause a fall. Remember, one-third of the fatal accidents in the home last year were due to falls. Some of these were from unsteady step-ladders. A step-ladder should be in good condition and it should be spread out correctly when used. A chair should not be used to step on to hang a picture or to reach some height for other purposes. This is a frequent cause of accidents. When a rocking chair is used as a step-ladder, beware. Small children like to climb, and then they are likely to fall if they are not on a secure perch. Therefore the necessity of keeping out of sight the things that they would be tempted to seek.

A child will reach for the handle of a vessel on a stove and might dump it on his head. Turn the handles toward the center of the stove and out of reach of the child. Keep the coffee pot well away from the table edge so the child cannot pull it off. For her own protection the housewife should pour hot liquids with the spout away from her so there will be no danger of being scalded by hot steam. Many women do not practice this precaution merely because they have never thought of the advantage, safety experts say.

Hanging the wash on fire-escapes is a bad practice and might lead to a dangerous accident.

The handles of pots and pans should be turned toward the center of the stove, far out of reach of children who, in attempting to grasp the handle, might spill the contents and become badly burned or injured for life.

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IN THE HOME

Happiness by Preventing Accidents

THACKWELL

Clothes should not be hung over a stove to dry because, if they are not constantly watched, they may catch fire. Kerosene should not be poured on a wood fire to speed ignition. Persons have been killed by explosions that resulted from this heedless act. Gasoline should never be substituted for kerosene.

SOME SAFETY HINTS

IT seems needless to point out that a person should not look for a gas leak with a lighted match, but that thoughtlessness last year caused deaths and fires. Soapsuds can be applied to a pipe or connection where it is thought there may be a leak. If tiny bubbles appear, the leak has been found. The gas should be turned off and the company should be notified.

The oven door should always be opened before the gas is lighted. The lighted match should always be applied just after the gas is turned on. An accumulation of gas and air causing an explosion often follows failure correctly to light gas.

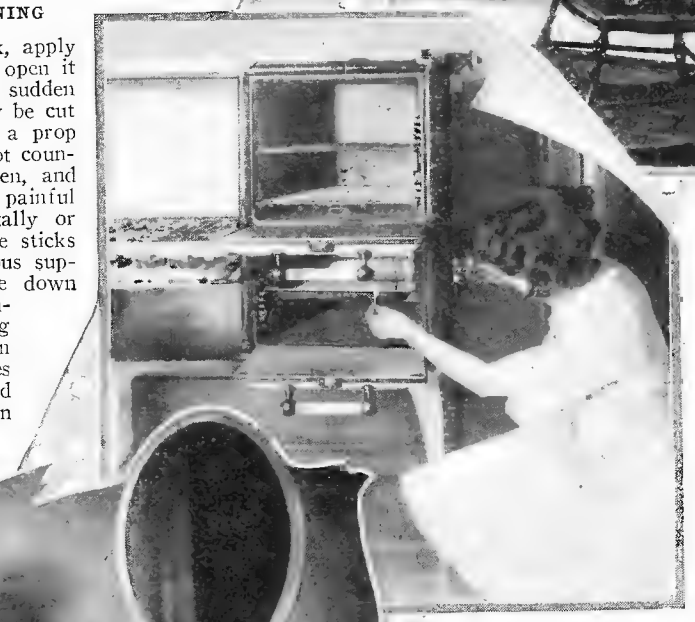
A curtain should not be thrown back over a gas fixture or should not be arranged so that it might blow across a flame. Coats and other things should not be hung from a gas jet because this tends to weaken the fixture and might cause a leak. A window of the house should always be open so that in case of escaping gas from some cause or other at any time there would be an outlet for the gas and a means of letting in fresh air which would prevent a possible asphyxiation. A woman prepared dinner and then went to sleep in a kitchen chair, expecting to awaken in plenty of time for return of the family. The food on the stove boiled over and this put out the gas. But the unlighted gas continued to pour from the burner and, because all the windows of the home were closed, it quickly filled the place. It was not possible to restore the woman, who was overcome in her sleep.

When fat is used for frying, alert care should be given to see that it does not spatter the hands or face, thus causing burns. If it boils over atop the stove, a handful of salt should be thrown over the flames.

PREVENTING BLOOD POISONING

IF a window seems to stick, apply force steadily in trying to open it and do not try to do so by sudden jerks and thumps, or you may be cut by broken glass. Never use a prop to hold up a window that is not counterweighted, for many children, and even adults, too, have suffered painful accidents when they accidentally or out of curiosity removed these sticks or other makeshift and perilous supports and the windows came down with a terrifying bang, catching the hand or arm and causing bruises and perhaps broken bones. See that proper catches or other devices are installed to hold the window up, when you want it open.

Pans containing poisonous or hot liquids should be set well out of reach of children. The Safety Council claims that 90% of the accidents can be avoided if proper precautions are taken. More than one-half of all the deaths by burns are of children under ten years of age.



One-third of the fatal accidents last year were due to falls. A chair should not be used to step on when hanging a picture.

It seems needless to point out that many persons lost their lives last year through carelessness in lighting the gas. The oven door should always be opened before the gas is lighted, and the lighted match should always be applied two or three seconds after the gas is turned on, never more.

Poisons should be put away where they cannot be mistaken for some harmless preparation. The bottle should be labeled clearly. Statistics show that during the last year, 2,000 persons met their death by being poisoned through carelessness.

Be very careful in using tools and household equipment. A hatchet handle should be secure. Keep the hand a respectful distance from wood, when sawing, else the saw may jump back and cut the hand. Accidents happen in opening glass fruit jars. Use caution and take your time, and if they break, discard the entire contents of the jar rather than run the risk of feeding broken glass to your family. Take your time in opening a tin can. Be careful not to be cut by the jagged edge. When you handle firewood, why not wear a pair of gloves? Splinters and rusty nails cause blood-poisoning and that sometimes causes death.

The time and labor-saving devices constantly being invented and marketed to make woman's work in the kitchen easier and more efficient frequently include safety attachments. Some of the latest electric irons have automatic devices to shut off the current when they get to a specified temperature and some do not. If yours does not, then be careful in using it and never, never leave it on the ironing board with current turned on while you run to answer the telephone or doorbell. You do not know how long you may be absent, and in the mean-

(*Continued on page* 569)

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THERMITING ICEBERGS

Ice Jams Cost Millions of Dollars Yearly; Prof. Barnes Tells How to Break Up Ice Formations Cheaply and Simply *

By HOWARD T. BARNES
Professor of Physics, McGill University, Montreal, Canada

INTRODUCTION

IN giving this little account of Ice Fighting, I have in mind always a time when mankind will wake up to the fact that we are masters of our destiny, and that with modern engineering skill anything in reason is possible. The children of to-day

A charge of ninety pounds of thermit reacting in ice on the St. Lawrence River. This charge lifted up a mass of ice 8,500 feet square and 9 feet thick, broke it and the pieces floated down the river in a few minutes. The metal container of the charge is seen shot up in the air to a height of 100 feet.

will be the men of affairs to-morrow, and therefore I am always glad to address the younger audience, hoping that their receptive minds will become interested in the facts of Nature, and will thus realize what can be accomplished even under a generation grown up with the idea fixed in their mind that ice and snow is a visitation of the Almighty like the weather, and therefore incapable of being modified.

It is wonderful in retrospect to look back to the progress during the past 30 years in handling ice and snow, and it is a conservative mind indeed which cannot look forward to the next 30 years with assurance of the tremendous progress which will be made.

COST OF ICE AND SNOW TO THIS COUNTRY

THE annual tax imposed on us by Jack Frost is enormous. In our waterways we find the navigation ceasing with the advent of winter, and where means are found for breaking ice the expense must be borne by the Government so great is the cost.

In the great Port of Montreal, closed for five months of the year, the weekly loss runs to $15,000,000. In the operation of automobiles, no estimate of the millions lost has been made. All our Taxi Companies report thousands of dollars spent in damage done every winter.

In the operation of the railroads, the clearing of snow from the tracks and the thawing of switches represents much money. In delays to traffic, no estimate has ever been made. Every snow storm costs the City of New York about one million dollars for snow-removal alone.

The great water power plants situated on northern rivers are seriously affected by ice, and many of them are reduced to half their summer capacity.

The loss to telephone and telegraph lines due to sleet is very serious.

All this represents loss, and is therefore never considered as money made when saved. To this I ascribe the apathy and the reluctance displayed by the big interests and the Governments in directing concertive study to the problem of fighting ice and snow.

This is why I want all the boys and girls of this country to think over this matter seriously and to realize the need for careful study of remedial work in saving the vast fortune which is slipping annually through our hands.

MILLIONS of dollars worth of business, not to mention many lives, is lost every year in the United States, Canada and other parts of the world, due to great masses of ice which pile up and prevent navigation of rivers and harbors. Also great masses of ice in lakes and rivers are frequent causes of disastrous floods, representing another huge monetary loss.

Professor Howard T. Barnes, of McGill University, Montreal, Canada, is probably the greatest expert in North America on the problem of how to rid harbors, rivers and lakes of dangerous ice formations. Prof. Barnes has also developed a remarkable method of attacking and destroying icebergs, those dangerous menaces of sea voyages. Prof. Barnes has perfected a remarkably simple method of applying thermit to the destruction of huge quantities of ice, such as icebergs.

NEED OF MILITARY PREPAREDNESS

IN all respects the coming of winter brings the enemy ice and snow with regular recurrence. Ice must be regarded as an enemy to mankind, for since the earliest dawn of history man has been fighting the encroachment of ice for his very life. No one fact of Nature has influenced so fundamentally the whole course of human history as ice, for the great ice ages of the past have driven men from their homes and modified the mode of life just as they will in the future.

But what is done in the case of the approach of the enemy must be done in the case of the approach of winter. Preparations must be made, and forces organized to meet the on-coming of ice and snow in time to temper its effects and prevent its gaining the hold and paralyzing the industries of the country.

You may ask how can this be done? All I can do is to try to explain to you how it has been done so far, and what can be done with wonderful results in the future.

METHODS OF ICE FIGHTING

IN our rivers and lakes one great barrier is the copious formation of ice on the surface. Every year many grain vessels are caught on the great lakes by a sudden drop of temperature. With a low temperature ice thickens rapidly and resists all efforts but that of special ships called ice breakers to move it.

Navigation is impeded and ships are injured by the sharp edges of the ice as they are forced through the solid pack. The new ice on a cold day is like a sharp knife, and cuts or ruptures wooden or steel plates, causing leaks to start.

In many rivers other serious conditions arise owing to the channels remaining open after the bays and shallow areas have frozen over. Great fields of ice move out and block the channel, into which the broken pieces of shore ice become packed and the whole cemented by snow blown into the water and fine ice crystals called frazil and anchor ice which forms in the open water on the bottom and is carried by the current into the pack. Thus an ice jam is produced which dams back the water and causes the river to overflow its banks and flood the surrounding country. So severe are these winter floods that many farmers have to resort to their upper stories every year and go about from one farm building to another in boats. This results in great loss and suffering to man and beast.

The Canadian Government has three ice breakers on the St. Lawrence River, which are stationed at Quebec City and operate all winter through Cap Rouge where the great Quebec Bridge is situated, in order to protect the river bank from the flooding. These boats have been working since 1908, and have

(*Continued on page* 540)

A terrific explosion takes place when thermit is used to crack and break up ice jams. In this case the thermit can was shot high in the air, and the whole ice sheet was lifted and ruptured.

* Subject of a lecture given by Prof. Barnes in WRNY's "University of the Air" Series.

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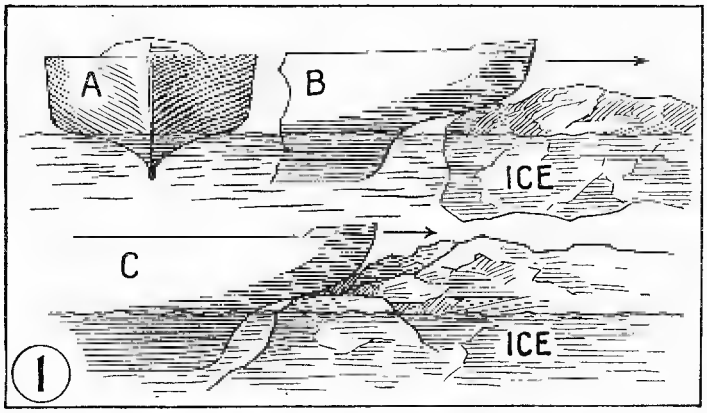
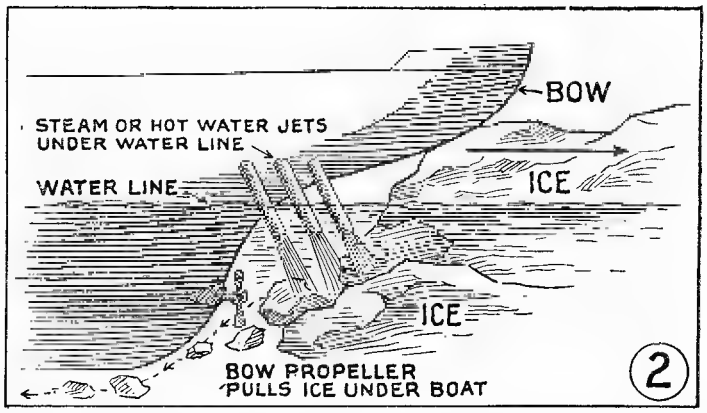
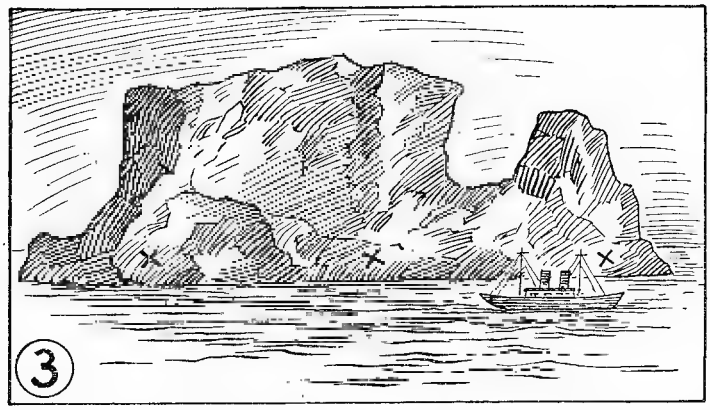
Steel Nosed Ships and Thermit Break Up Ice



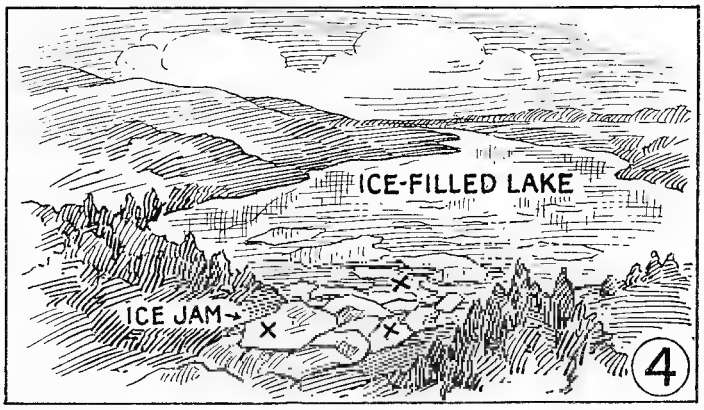
Boats used for "ice-breaking" are specially constructed; cross section shape preferred at A; B shows shape of bow, and C shows later stage.



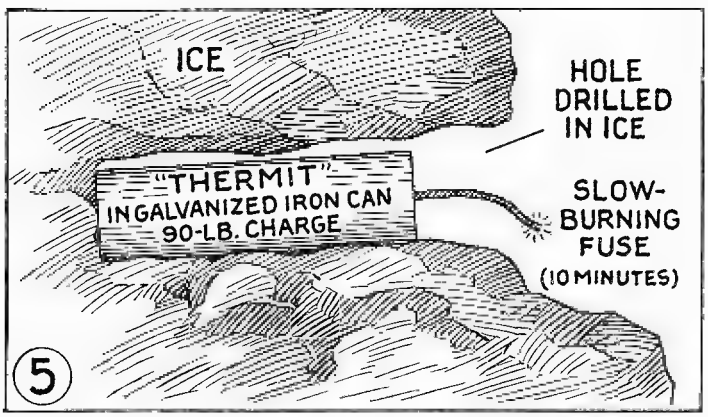
Bow propellers have been found useful on Canadian ice-breakers to move the broken ice sternward. In some cases steam and hot water jets are also employed.



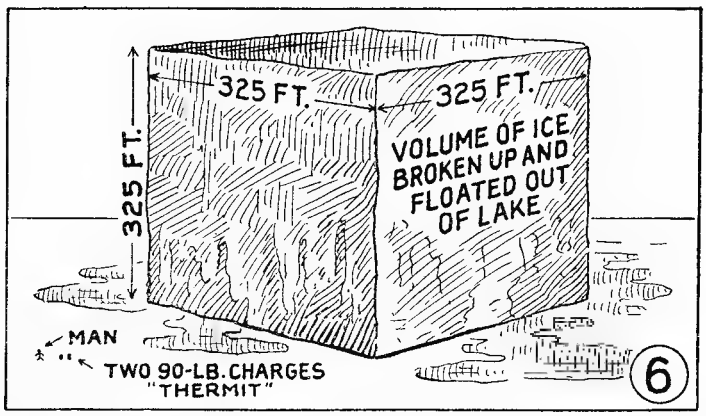
In thermiting icebergs, according to Prof. Barnes' method, three ninety-pound charges of thermit would be placed in holes drilled at points marked X.



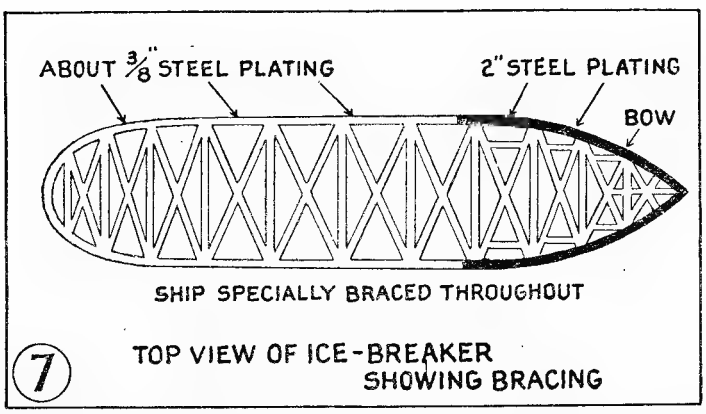
In many cases an ice jam occurs at the outlet of a lake, and the points marked X show where thermit charges may be placed to loosen the jam.



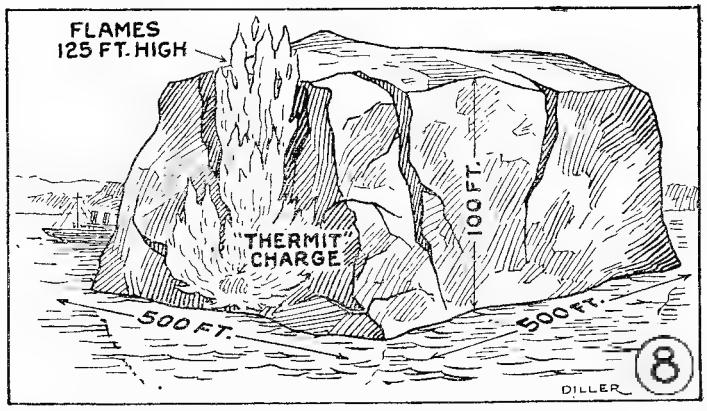
Above we see how a ninety-pound charge of thermit in its galvanized iron can is placed in a hole cut or drilled in an iceberg. Note the fuse.



In a big ice jam at Ogdensburg, N. Y., two ninety-pound charges of thermit succeeded in breaking up a million tons of ice, which floated out of the lake.



How ice-breaker ships are built, the bow being reenforced with two-inch armor steel. The inside of the hull is strongly cross-braced with steel girders.



In connection with our cover illustration, this picture shows the magnitude of the flames, when a ninety-pound charge of thermit broke up an iceberg.

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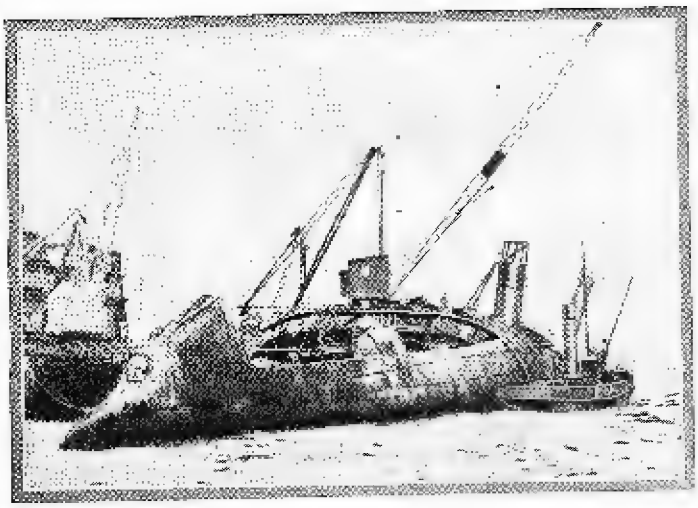
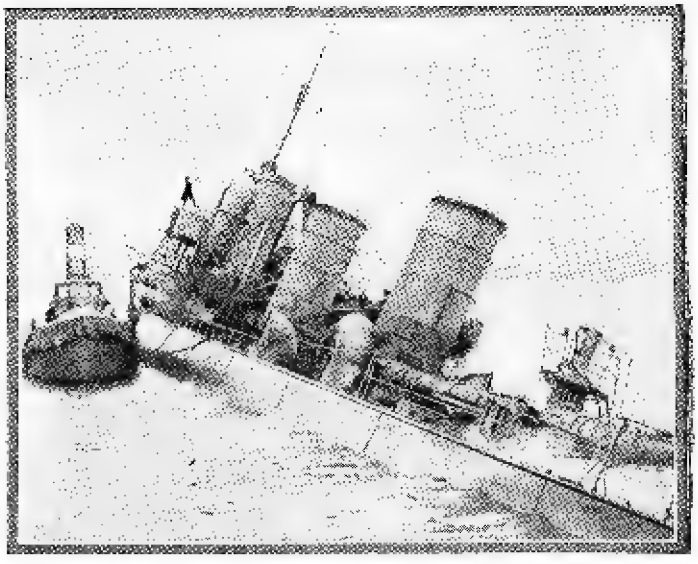


The above photograph shows the German battle cruiser *Moltke*, which was raised from the bottom at Scapa Flow, Scotland, where it had been sunk after the war. The two air locks may be seen attached to the bottom of the hull. The cruiser was refloated largely through the agency of compressed air.



View of a salvaged one-thousand ton destroyer appears above.

Raising the German Fleet

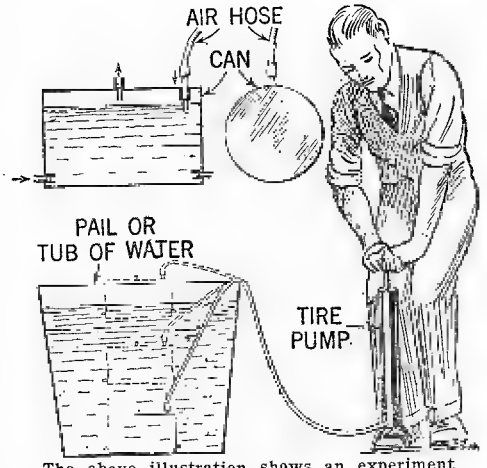
Sunken Battle Cruiser and Twenty-Five Destroyers Salvaged

By H. W. SECOR

UNDER the terms of the Armistice the German government was to give the British Admiralty the bulk of the fleet. These ships however, were sunk by the officers who had been ordered to deliver the ships to the British. Since that time eight years ago, the German fleet had reposed on the bottom of the ocean off Scapa Flow, Scotland. The German battle cruiser *Moltke* and some twenty-five one-thousand ton destroyers lay on the sea bottom off the Orkney Islands.

DESTROYERS SALVAGED

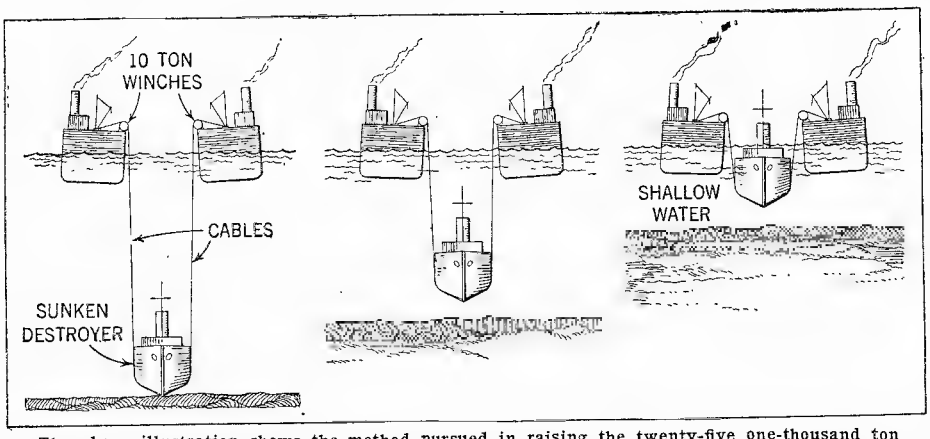
RECENTLY, the British salvaging corporation undertook to raise the ships and was successful in their attempts. A submergible testing dock was towed to Scapa Flow, and was then cut in half, each half being equipped with a number of ten ton winches provided with strong steel cables. With these winches, it was possible to exert a two thousand ton lift on the lines and raise the 1,000 ton destroyers one by one. Divers passed a number of the cables beneath each vessel which was thus successfully carried to the shore. The outstanding engineering achievement, however, was the raising of the German battle cruiser, the *Moltke* which lay on a sea bed off the west shore of Cava Island in water having a depth of seventy-two feet. The cruiser listed sixteen and one half degrees to port and her bow was higher than her stern. The ship is six hundred and ten feet long, draws twenty-eight feet of water, and has a displacement of twenty-three thousand tons. The vital portions were guarded with armor plate ranging in thickness from four to eleven inches, which added greatly to the weight of the ship. When the German crew flooded her, she capsized and came to rest on the bottom in a position which made salvage work extremely difficult. Her masts and funnels were broken off and the bridge had been crushed and gun turrets damaged, says an expert in *Compressed Air Magazine*. Before actual operations could take place, it was necessary to remove the entanglements so that the divers would not be hampered.



The above illustration shows an experiment which can be carried out to illustrate the principle of raising sunken ships with compressed air. A can fitted with check valves immersed in a pail of water has a hose connection with a tire pump. The can may be filled with air and will float.

HULL MADE WATER-TIGHT

THE plan finally accepted was to place the cruiser in an upright position and bring her to the surface by use of compressed air. Before this could be accomplished, however, it would be necessary to make the hull air-tight. An air lock was constructed in the ship's bow and gave access at a point about fifty feet in front of the boiler room water-tight bulkhead. This distance had to be traveled by the divers in going to that compartment. Due to the fact that the stern lay at a greater depth than the bow, it was necessary to construct an additional air lock so that entrance could be gained to the engine room. The placement of the air locks and the position of the ship may be seen in the illustration. Because the cruiser rested upon a sloping sea bed, the raising of the bow and the stern would have tended to depress the stern still further. Accordingly it was necessary to apply other means in addition to compressed air to get a uniform lift. The submergible dock used in raising the destroyers was again brought into action. One section was placed above the wreck and twenty-four steel cables passed down and around one of the turrets, and also attached to numerous other points. These lines were hauled tight, and as the tide rose, the buoyancy of the dock exerted a lifting power of about 2,400 tons. At the same time compressed air was forced into some of the after compartments to expel the water and to impart an added measure of internal buoyancy. Although the steel cables were nine inches in circumference, many of them were broken during this operation. Despite the efforts of the divers, it was impossible to make all the bulk-



The above illustration shows the method pursued in raising the twenty-five one-thousand ton destroyers. The two halves of the submergible testing dock were fitted with ten ton winches. From these cables passed down to the sunken destroyer, which was raised and towed to shallow water.

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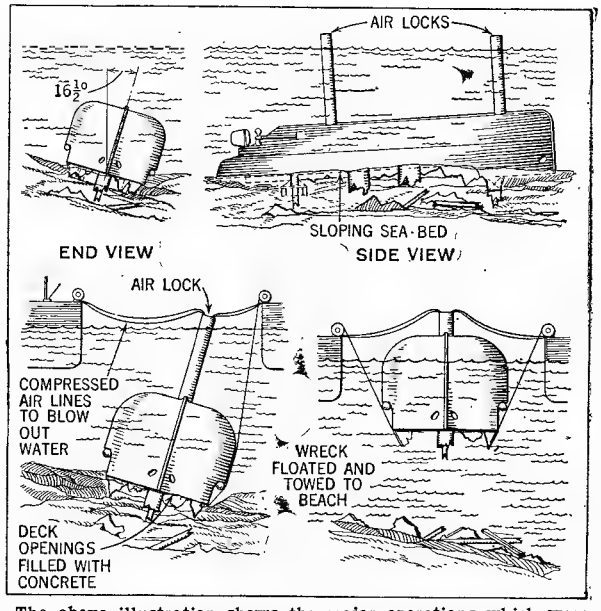
heads actually water-tight. When compressed air was forced into the lower points, some of it worked upward through these openings and accumulated in the foremost section of the craft. This air which was high pressure, tended to evacuate the water and increase the buoyancy of the bow. To neutralize this, a relief valve was fitted, so that the buoyancy could be regulated by controlling the amount of compressor air. The decks were made water-tight, and a second air lock being installed, it was possible to expel the water by means of compressed air. The leverage of the bow, however, was still so great that the list to port could not be overcome.

POSITION LEVELLED

THIS situation was coped with by employing half of one of the refloated destroyers which was attached to the starboard bow of the cruiser. This additional weight of 300 tons of metal and 200 tons of water was counted upon to exert



The above illustration shows the major operations which were undertaken in order to raise the battle cruiser.

a depressing and turning moment that would act in the same direction as that obtained with the cables. The list to port still persisted so another means was employed. The bunkers and tanks at the sides of the ship were made air-tight and the subdivisions on the port side were filled with air, while the subdivisions on the starboard side were flooded with 1000 tons of water. A pontoon consisting of one section of the floating dock was then moved to the starboard side of the *Moltke*. Twelve cables were passed from the pontoon over the destroyer and thence down under water and fastened to the deck on the port side. When the tanks of the dock section were charged with water, the increased dead weight exerted a pull and raised the port side thus overcoming the list. The dead weight of the destroyer was withdrawn and the bow immediately rose above water. In order to meet with the emergency, the relief valve was opened and then compressed air was directed to the interior of the after

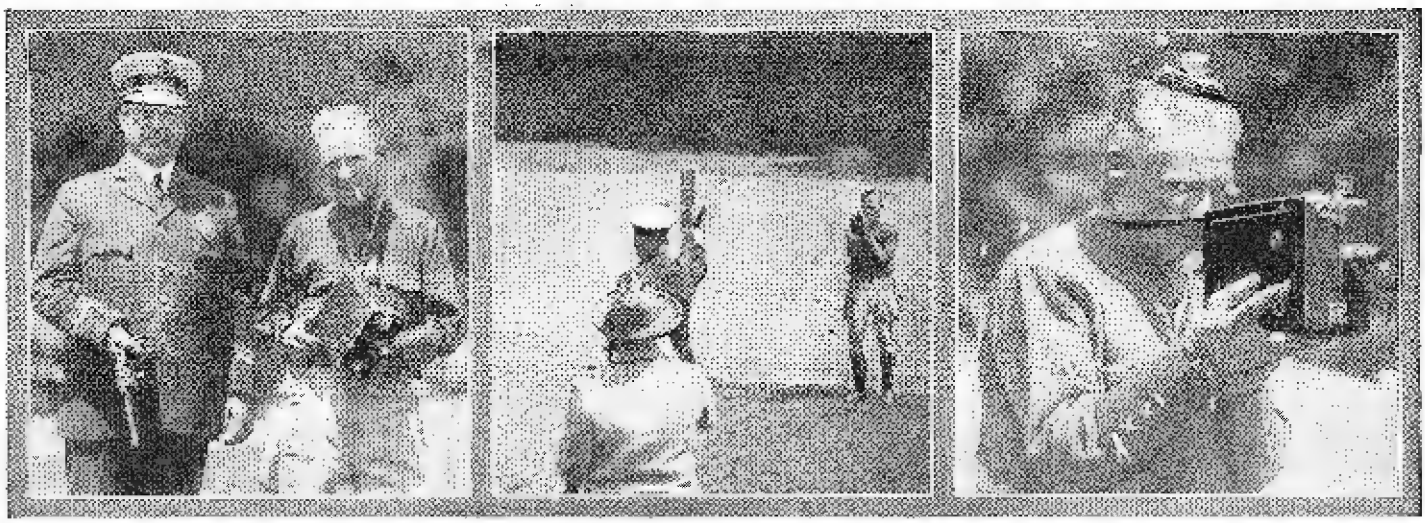
(*Continued on page* 566)

GEOGRAPHIC PUZZLE GLOBE

THE modern method of teaching by employing psychology has come to be recognized to be far superior to the old system where the student lived in fear of the rod. A new invention which may be termed a geographic educator has recently appeared on the market and is a combination globe and puzzle. A child unconsciously absorbs knowledge while playing with the globe. The device is divided into countries and and continents and has the added features of the air routes of Lindbergh and Chamberlain and the Hawaiian flights marked upon its surface. It is scientifically constructed to scale and is made of 38 individual inserts and 7 sectional pieces, 6 of which comprise the various continents and the other section, the North Pole. A child will readily recognize the fact that he cannot place any country in South America into another country, because it will not fit. Consequently, while he is playing with the globe and trying to find the location of continents and countries, geographic knowledge will be absorbed without his being conscious of the process. Each continental section, when separated from the globe, still shows that the globe is round at all times, as will be noticed by the curvature. Novel features of the device are its indestructible construction, and non-inflammability. Blind people will gain not only in education, but will have much enjoyment and entertainment by playing with this article. When teaching geography in schools, the pupil is asked to look at a flat map and imagine the earth to be round. A globe of this nature will help in the visualization of the earth as a sphere.

The illustration below shows the puzzle globe which is made in seven removable sections. The article is made of special plastic material which is non-inflammable, indestructive and washable. The globe is constructed to scale. *Name of manufacturer on request.*

NEW USE FOR MOVIE CAMERA



The above photograph shows Mr. McClellan and a Los Angeles police captain about to perform their latest stunt, which consists in shooting an egg from McClellan's head.

In the above photo, McClellan is focussing the camera and the police captain is taking careful aim at the egg. Note plugs in ears of McClellan. Camera is "shot" with gun.

Above is a close-up which was taken just after the bullet had broken the egg. Note the pieces of egg shell flying about.—*Photos courtesy De Vry Corp.*

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GEYSERS
Real and Artificial

By JOSEPH H. KRAUS

Above is a photograph of the geyser, "Old Faithful," in Yellowstone National Park.

GEYSERS are eruptive thermal springs. A geyser has a constant source of water supply below the surface of the earth. It may be likened to a sort of a tapering tube, into the bottom of which water pours from subterranean passages. At the surface there is usually a sort of a basin which has been built up by a deposition of silica.

Geysers are usually found in an area where hot springs are prevalent. Those in Iceland have been observed for centuries, whereas those of Yellowstone Park have been known from a comparatively recent date. In Yellowstone Park alone there are at least seventy eruptive geysers. True geysers erupt periodically. In Iceland, the great geyser has a pipe nearly 10 feet in diameter and it hurls the water into a height exceeding 100 feet. Its eruptive period is a day or more. The Giant, a picture of which is shown on the accompanying page and Old Faithful, also illustrated, both found in Yellowstone Park, throw columns of water to a different height. The former of these throws a column of water 5 feet in diameter to a height of 200 feet and it plays continuously for an hour and one-half. Old Faithful spouts every 65 minutes and there is a geyser, the Excelsior, which spouts every eight years.

Prof. Robert Bunsen, the inventor of the Bunsen burner, made researches in Iceland and then demonstrated in the laboratory and by laboratory experiment, his theory of geyser action. This is generally accepted by geologists as being a good indication of what takes place in mother earth.

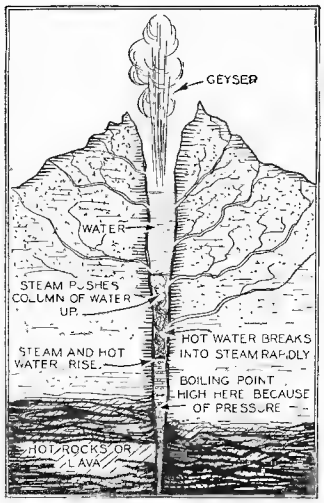
A model geyser built at North Western University is shown above. This seven-foot model threw a column of boiling water as high as the ceiling.

An excellent snapshot of a giant geyser in violent eruption at Yellowstone National Park appears above.

Referring to the diagram on this page, we can see that the column or pipe of the geyser will be filled with water as it seeps down through the soil to arrive finally at the nearly vertical pipe proper. This pipe leads to an area where there are hot rocks or lava, and the water is raised to such a point that it will boil. When the temperature in the lower part of the tube is great enough to cause the water there to boil, in spite of the superincumbent pressure of the column of water on the top, some of the steam bubbles are forced up into the area just above that occupied by the hot rocks or the lava. It is at this point that a violent rumbling commences. This rumbling is always heard prior to the geyser play. Some of this steam manages to force its way up to the top, and carries with it a portion of the water near the surface. Naturally there now exists a sudden relief of pressure and at the instant of this relief, the water at the base of the pipe, already heated to the boiling point, flashes into steam and throws the entire column of water above it into the air. One can frequently cause an eruption to be hastened by dropping stones into the pipe of a geyser. The reason here is again the same. The stones dropping in cause the water to circulate a little more rapidly and the water at the lower region under pressure and practically at the boiling point is permitted to move upward,

(*Continued on page 567*)

At the left is a view of Lone Star Geyser cone at the Yellowstone National Park. At the surface of each geyser is usually a sort of a cone which has been built up by a deposition of silica.


GEYSER
WATER
STEAM PUSHES COLUMN OF WATER UP
STEAM AND HOT WATER RISE
HOT WATER BREAKS INTO STEAM RAPIDLY
BOILING POINT HIGH HERE BECAUSE OF PRESSURE
HOT ROCKS OR LAVA

The illustration at the right shows the reason a geyser erupts and how the boiling water and steam is forced up into the air. Geysers are eruptive thermal springs and have a constant water supply beneath the surface of the earth.

The infernal region, giving up some of its power. A geyser photographed at the time of its eruption is shown at the right. These spouting columns of water are regarded by many as being the second greatest natural wonder in America.

By referring to the illustration at the left, it will be seen that the geyser has a water supply beneath the surface, and a tapering passage into the bottom of which the water enters. The hot water breaks into steam, which in turn pushes up a column of water.

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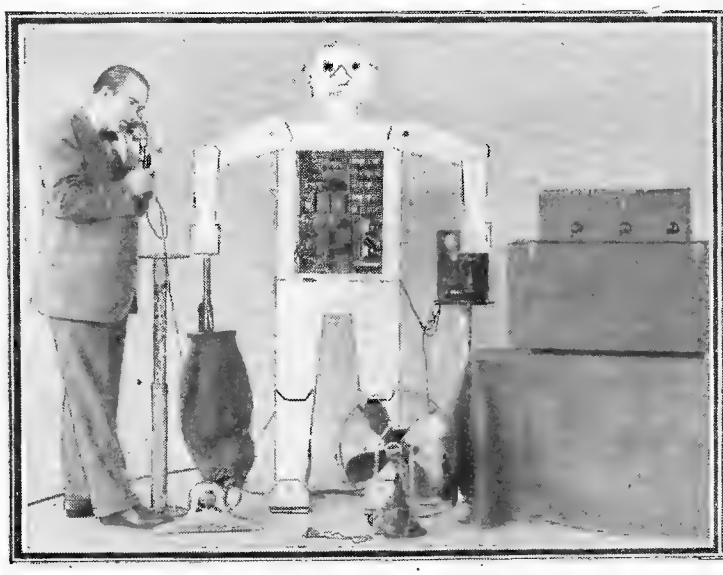
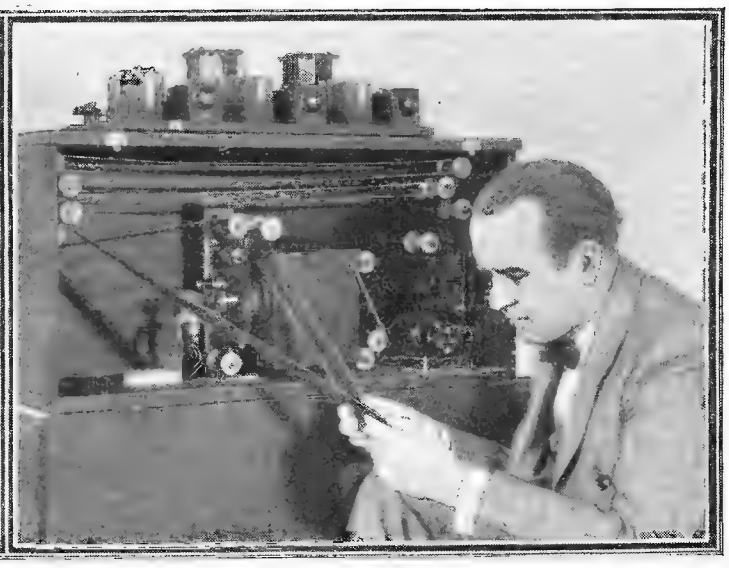
HOW THE TELEVOX TALKS

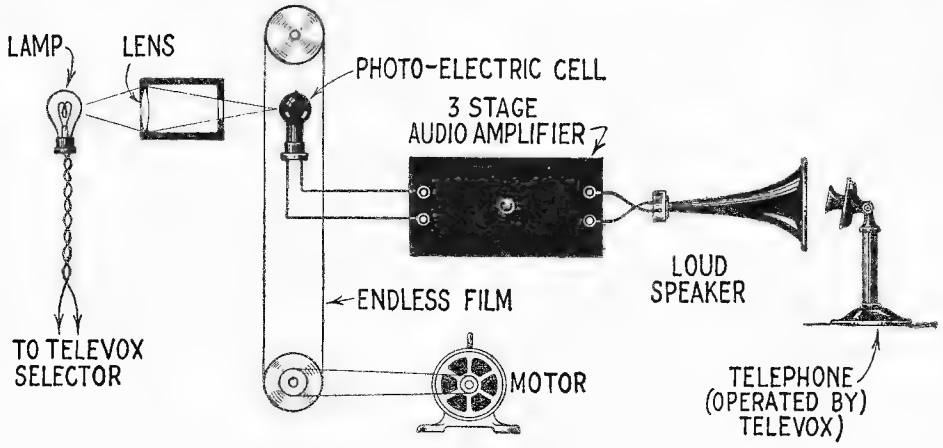


The above photograph shows the inventor, Mr. R. J. Wensley, demonstrating his mechanical man, which has now been given a voice.



Speech is recorded on a "movie" film and produces a suitable sentence sending it over the telephone wires to the operator. The film is shown here.

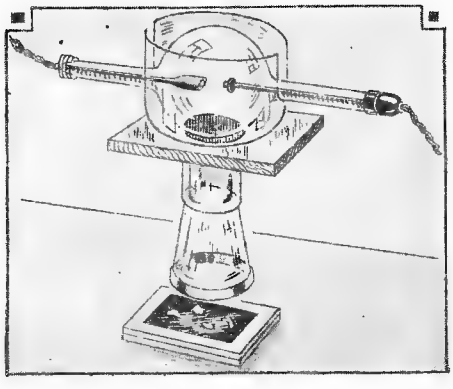
IN order to make the equipment more suitable for use over a public telephone system, the Televox has now been given a voice. To give the mechanism means for producing articulate speech, a piece of moving picture film is spliced to make an endless loop. In the present model two sentences are spoken and are recorded near the two edges of the film. The sound is registered in several closely spaced lines of various shades and widths. A small motor drives the film whenever the voice is required, and a selecting mechanism lights either one of two lamps, depending upon the sentence required. The light from the lamp passes through a condensing lens, through the recorded speech on the film and strikes a photo-electric cell. Here the light rays are changed into electrical pulsations, are amplified and directed to the mouthpiece of a telephone transmitter which is also operated by the Televox.



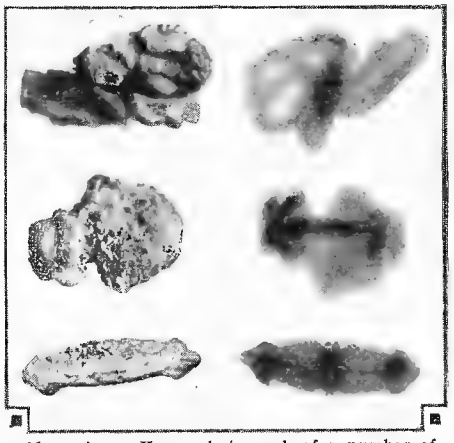
The above illustration shows how the Televox talks. Light rays pass through the film and strike a photo-electric cell.

X-RAY PHOTOGRAPHS OF ANTIQUES

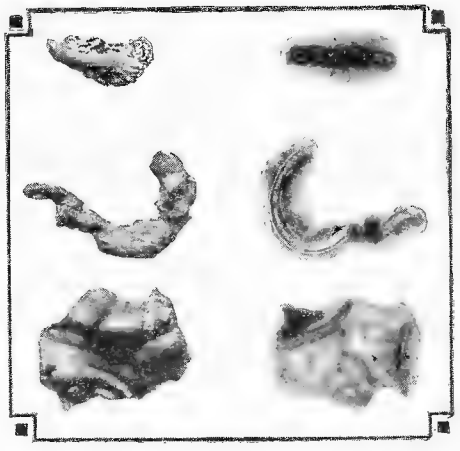
A SWEDISH engineer, Mr. Gillis Olson, at the Historical Museum of Sweden, has discovered a new method of dating old things by means of X-ray photographs. In this manner the original case of the antiques can be studied without harming them. Formerly it was necessary to scrape the surface in order to find out just what they were made of and estimate their probable age. Many valuable objects were thus ruined and made practically worthless. With the help of the X-ray photograph, it is possible to determine the best method of reconstructing the antiques without injuring them beforehand. The method is scientifically possible due to the fact that the different parts of the covering have different permeabilities for X-rays. The illustration shows the procedure, the X-ray tube being placed upon a stand beneath which the objects are placed. A special case is provided to hold these and also a sensitized plate. X-ray photographs of a fragment of a cross bar from a sword hilt, an iron rivet, a bronze buckle, a bronze chain and a bronze fibula appear here. The construction of the bronze fibula is clearly shown in the photograph, and the contours of the bronze buckle are sharply defined. The dark streak in the cross bar indicates the presence of silver in its construction—*Contributor please send name and address.*



The manner in which the X-ray photographs are taken is illustrated above. The objects are placed in a holder above the sensitized plate.



Above is an X-ray photograph of a number of antiques. By using this method it is possible to examine the object without injuring it.



Photographs of an iron rivet, a bronze chain, a bronze buckle and other similar antiquities are shown above.

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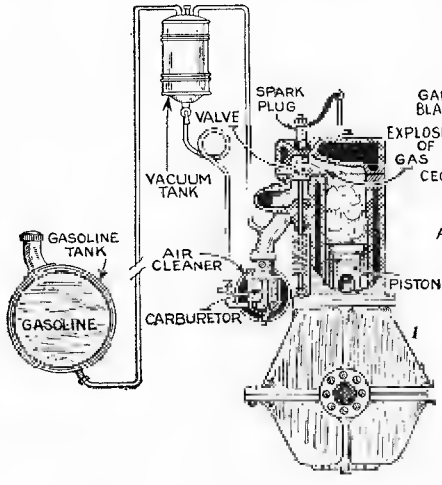
The Human and Auto Engines

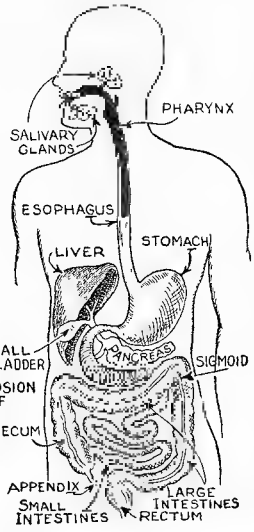
Some Striking Analogies Between Man and Motor

By C. T. SHAEFER

THERE is nothing new under the sun and this story is nothing new or startling, but an interesting tale which gives an analogy between the human engine and the motor car engine, so that you may gain a better knowledge of your engine and give it the same care you would have it receive when you understand its ills.

The motor car engine is a very close approach to the reproduction of human life. But few of us realize the peculiar and striking similarities between the human engine—human being—and the motor car engine. The chief attributes of the human engine are its ability to consume food, to cause that food to undergo chemical change which





At the left, the human engine and automobile engine are compared. In the human engine we take in food, mix it with saliva, and otherwise prepare it to undergo a chemical change. In the motor car engine, the fuel which represents the food enters the carburetor, is mixed with air, in preparation for the chemical change which it later undergoes. A passage connects the carburetor with the cylinder even as the food passage connects the stomach with the mouth in the living body.

gives rise to body heat and the conversion of the latent energy of the food into usable energy or mechanical movement which we call muscular and mental effort—to discard or throw off the waste products of this chemical action in several different ways and through various channels and to reproduce itself.

Offhand we say there is life when the body is warm, when it moves, when it eats and when it breathes. Dash, "pep," reliability, perversity, meanness and sickness are among the human traits possessed by different engines to a greater or less degree, according to design, workmanship, treatment or conditions. And when aught goes wrong the engine will actually speak, as many of you know, first in a whisper, but always with rising inflection as to intonation when its ills are not attended to or its wants not provided.

Did it ever occur to you that that inanimate object of metal under the hood can actually talk—and that those who know can interpret its sayings? Yes, there is even music in an engine, for there is no music without rhythm—no harmony without keeping time. Rhythm is the pulse of music and the dance is its physical expression. Through rhythm the dancers achieve their harmony of movement, their exhilarating unity.

In the motor car engine we have this same understanding and harmony between each part, each tuned and timed with patient care, providing smooth, effortless running and unceasing power. As the events taking place within the cylinder must follow in exact sequence, it is essential to have harmony—exact time—in other words, the engine cannot function properly without rhythm. There is the rhythm of music and the music of rhythm in every engine.

The steady, uninterrupted purr of the engine over its entire speed range tells us that "all's well"—and when the engine speaks to us in these terms, it is like a friend bearing good tidings and beaming on us as he relates the gleeful tale. But it is quite different when some "tap, tap, tap"—some "klank, klank, klank"—or some "rap, rap, rap" breaks into the rhythm of the engine's purr. You do not have to be an expert to distinguish between "right" and "wrong" when the engine gives this audible account of its condition. But it requires a motor car "M.D.," a good diagnostician, to correctly diagnose the symptoms of the various ills to which the organs of the engine are subject.

Unless you are familiar with its construction, don't monkey with the adjustments, for adjustment is not a standard remedy for all the ills of either the motor car engine or the human body.

HOW FUEL IS PREPARED

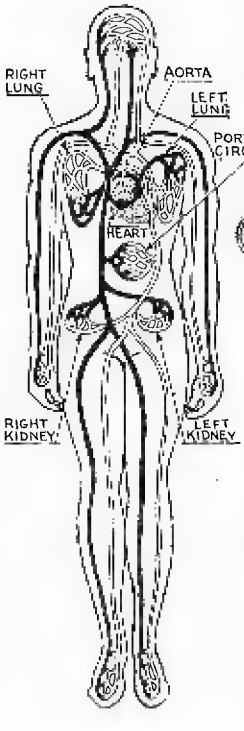
LET us compare the two engines to see how closely they resemble each other. In the human engine we take food into the mouth, masticate it, mix it with saliva and otherwise prepare it to undergo the more or less rapid chemical change before it passes down the food passage connecting the mouth with the stomach and enters that cavity and prior to the action of the gastric juices upon it. In the motor car engine the fuel which represents the food of this engine enters the carburetor in which it is pulverized or atomized exactly as the food was in the mouth of the human engine; being mixed with air—the equivalent of saliva—in preparation for the chemical change which it is to undergo. A passage connects the carburetor with the internal cavity in the cylinder even as the food passage connects the mouth with the stomach in the living body, and through this passage the fuel flows when the inlet valve is opened.

CHEMICAL ACTION

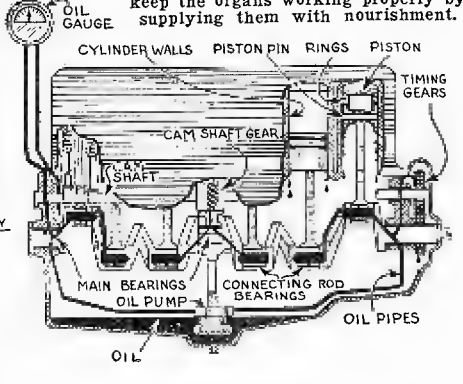
THE chemical action takes place in either engine. However, in the motor car engine this is much more rapid. In the body a slow chemical decomposition takes place immediately after the food enters the stomach which later (on absorption) gives rise to body heat. This chemical action continues until the last bit of heat has been extracted from the food. The waste products are then expelled to make room for new food. As this chemical action takes place at a much more rapid rate in the motor car engine, the liberation of heat is also more rapid. And when the food or fuel has been consumed and its heat liberated, provision is made for getting rid of the waste products through the passage called the exhaust. Thus we see both engines require heat and nourishment for their active existence, therefore, both are thermal engines. Both must have nourishment in the form of food to generate first, the required temperature, then their energy and power. Neither engine can give forth its best efforts until the requisite normal temperature has been reached. But the heat generated from the food is applied in slightly different manner in the motor car engine.

HOW HEAT IS APPLIED

IN the humane engine the heat generated by the body is applied to the muscles, and there converted into mechanical energy, that is, we must have nourishment to generate the energy necessary to move our muscles with which we do work. Literally speaking, the engine has no muscles, but the intense heat generated expands the gases of the fuel and the pressure created acts on a movable member called the piston which, being a loose fit in the cylinder, is driven out just as a cannon ball is projected out of the gun by the pressure of the exploding charge back of it.



The blood circulatory system is compared below with the circulation of oil in a motor engine. The function of the blood is to check wear and remove particles of dead matter, and keep the organs working properly by supplying them with nourishment.



The piston is restrained in its movement and not free like the cannon ball, being tied to the crankshaft, which is a free fit on its bearings, so it turns readily by means of

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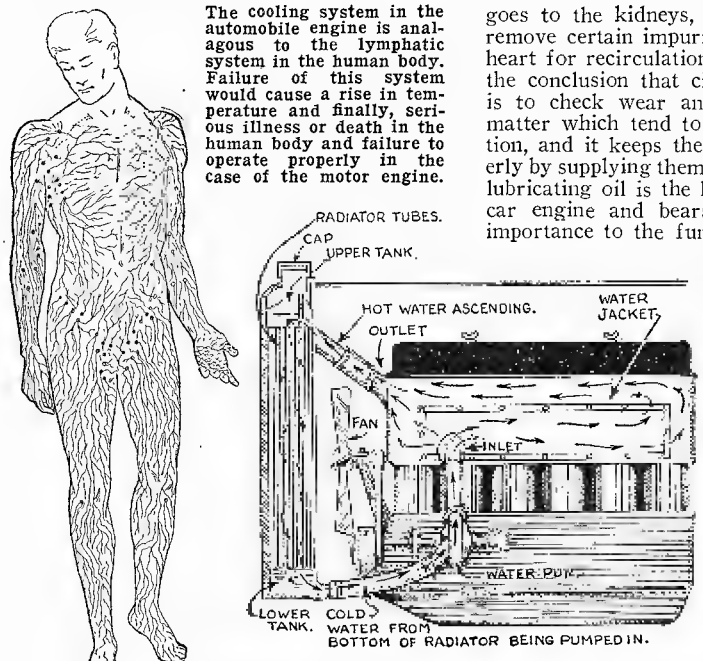


The cooling system in the automobile engine is analagous to the lymphatic system in the human body. Failure of this system would cause a rise in temperature and finally, serious illness or death in the human body and failure to operate properly in the case of the motor engine.

the connecting rod, the intermediate member between the crank of the shaft and the piston. When the piston moves outward, therefore, it turns the crank, which turns the flywheel on the shaft and we get mechanical motion even as we do from the body muscles.

The piston, in some respects, functions somewhat similarly to the lungs of the human engine which form the respiratory organs, successive breaths of fresh air throw off foreign matter (some of which is halted in the nose), but the lungs of the engine have no such cleansing apparatus to aid them, although cleanliness is of equal importance to both human and mechanical life. When the piston moves down in the cylinder it draws in atomized fuel and air, but also impurities which may be present in the air. On its return or upward stroke the fuel and air mixture is compressed and churned, which prepares it for combustion, the process in which the heat is liberated. Combustion or digestion of the fuel in the engine is caused by permitting an electric spark to pass through the mixture, and as combustion takes place, the heat is generated. This heat causes the gases to expand and forces the piston down in the cylinder. When the piston has moved out as far as the crank will permit, the exhaust valve is open and the piston comes up again under the urging of the momentum stored in the flywheel and the waste products of combustion, the spent gases, are forced out of the cylinder.

We breathe, as you know, and our breathing apparatus consists of a channel (the nasal capacity of which acts as a filter) and a passage way leading to our lungs. The latter, we are told, are simply a modified form of bellows. When the bellows expand, the vacuum created causes the air to rush in through the nasal cavity to the lungs, filling up the void. The engine also breathes through a little passage we call the breather, which is provided with a fine mesh screen to prevent dirt and grit which may be held in suspension in the air from entering the passageway. In some cars, such an air filter is provided.

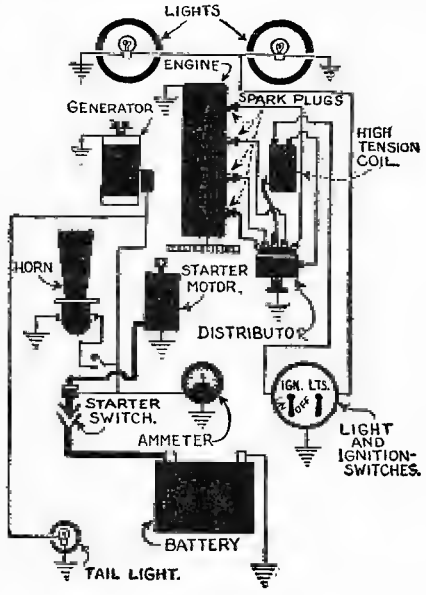
THE CIRCULATORY SYSTEMS

IN the blood circulatory system we have a fluid, the composition of which is of the utmost importance, circulated to each and every part of the body where wear occurs and nourishment is required. Circulation is maintained by means of a pump—the heart. In the course of circulation the blood passes to the lungs, where it is brought in contact with the pure air and purified; some of it goes to the kidneys, where it is filtered to remove certain impurities and returns to the heart for recirculation. From this we reach the conclusion that circulation of the blood is to check wear and remove particles of matter which tend to give rise to deterioration, and it keeps the organs working properly by supplying them with nourishment. The lubricating oil is the life blood of the motor car engine and bears the same degree of importance to the functioning of the engine as blood does to the human body, except that it does not carry food supply. Its function is to eliminate friction and remove particles likely to cause wear, and it is also circulated to all parts where wear is likely to occur. It is brought into contact with fresh air when the engine breathes. For, as the piston moves upward in the cylinder it tends to create a vacuum in the crankcase, and it is this vacuum which causes air to be drawn into the crankcase just as the vacuum in the lungs causes the air to fill the lungs. The air does not remove impurities, as in the case of the lungs of the human engine; however, it does perform the function of lowering the temperature of the oil, which is a mighty important point, since this aids in cooling the engine. The air enters through the breather.

THE COOLING SYSTEMS

ANOTHER system of considerable importance in the proper operation of the motor car engine is the cooling system. We also have an analogy to this in the human engine which the medical profession calls the lymphatic system. This system circulates a colorless, limpid liquid and serves to remove from all body tissue certain waste materials. Failure to remove these waste materials would cause a rise in temperature due to deterioration or mortification of the tissue and finally serious illness or death.

The temperature of the motor car engine is controlled by the circulation of the cooling medium through the water jackets of the engine. The waste material being removed in this case is heat—the heat which radiates through the cylinder walls and is not converted into useful energy. If the cooling system fails to function, the result would be precisely the same as in the case of the human engine.



THE ELECTRICAL SYSTEMS

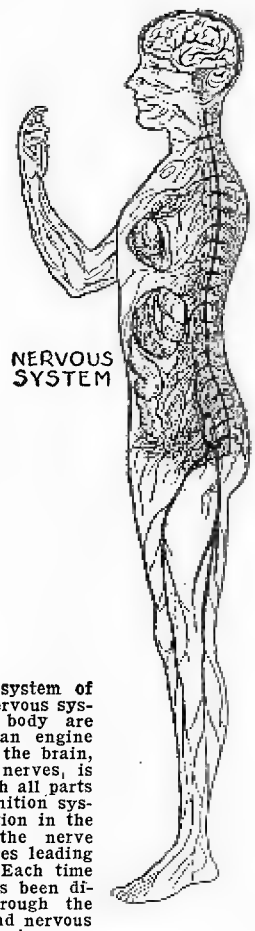
THE human engine is controlled through the brain, which by means of the nerve system is in communication with every muscle in the body. The ignition system serves this function in the motor car engine, the nerve system being the wires leading to the spark plugs, and each time a cylinder fires it has been directed to do so through the action of the brain and nerve system of the engine. The foregoing paragraphs give a comparison between the construction and operation of the human engine and the motor car engine. The analogy may be carried still further and it will be discovered that both engines are subject to ailments which are very much alike.

When the human engine does not masticate its food properly—does not prepare it fully in the mouth for the chemical change which it must undergo—indigestion results. The constitution of the motor car engine is subject to the same ailment. If, for one reason or other, the carburetor does not properly atomize and prepare the fuel on which the engine thrives, it will have a spell of indigestion or, in mechanical terms, incomplete combustion—the engine has a case of stomach trouble. Improper feeding or poor combustion quickly robs the engine of its suppleness and life, and renders it sluggish and intractable. A healthy engine, like a healthy body, is always ready to work and eager to do so and needs no doctors or dentists, physics or patent foods. The delicate are often laid up, incurring extra expense besides being unable to perform their daily tasks. Although one cannot select a pair of healthy parents, there is no excuse for permitting an engine originally in perfect health to develop a bad case of mechanical indigestion.

NORMAL TEMPERATURE

THE cooling, lubrication and breathing systems are likewise subject to ailments. The normal working temperature of the human engine is around 98.6 degrees Fahrenheit, and the working temperature of the motor car engine well around 160 to 180 degrees Fahrenheit. The difference is merely one of degree, one engine working more efficiently at a higher temperature than the other. A sudden rise in temperature above normal or any condition which does not permit reaching the normal temperature, indicates danger, and in each case calls for similar action. Both engines must be fit to work well, and a sudden rise of temperature above normal is a sign of unfitness. When the temperature is too low, neither engine

(*Continued on page* 549)



Above—the ignition system of the engine and the nervous system of the human body are compared. The human engine is controlled through the brain, which, by means of nerves, is in communication with all parts of the body. The ignition system serves this function in the motor car engine, the nerve system being the wires leading to the spark plugs. Each time a cylinder fires it has been directed to do so through the action of the brain and nervous system of the engine.

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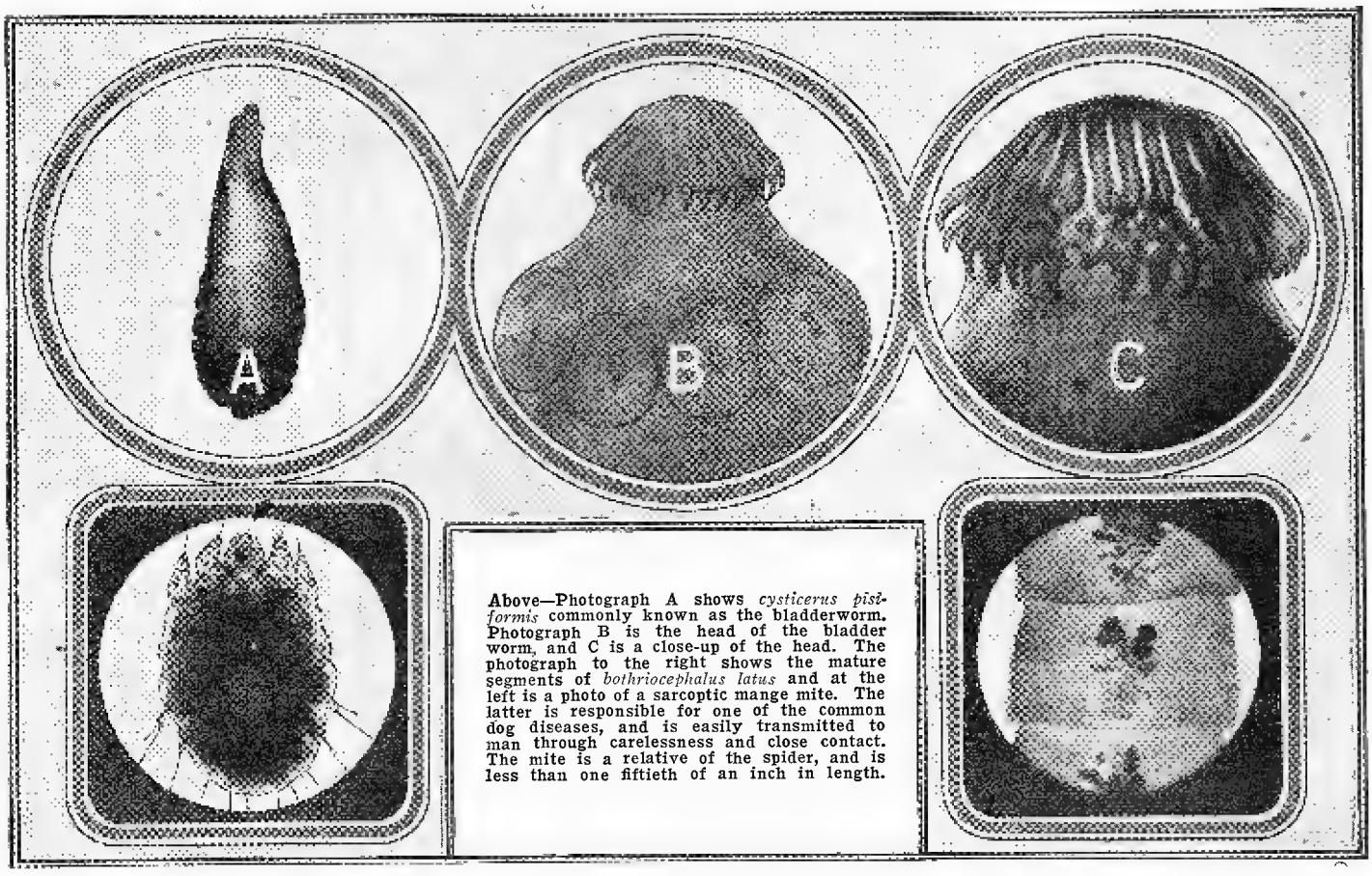
The Dog, A Transmitter of Disease

By DR. ERNEST BADE, Ph.D.



Above—Photograph A shows *cysticerus pisiformis* commonly known as the bladderworm. Photograph B is the head of the bladder worm, and C is a close-up of the head. The photograph to the right shows the mature segments of *bothriocephalus latus* and at the left is a photo of a sarcoptic mange mite. The latter is responsible for one of the common dog diseases, and is easily transmitted to man through carelessness and close contact. The mite is a relative of the spider, and is less than one fiftieth of an inch in length.

TAPEWORM A DANGER

OF all parasites which infest the dog the worst are the various types of tapeworms. They not only live upon the dog, but, due to their peculiar method of propagation, they are able to infest other animals as well as man. Although the dog often is a carrier of disease, no danger of transmission need be feared if ordinary precautions are taken. But when the dog is permitted to lick hands and face, when he is kissed, and when he is fed by hand and the next bite is carried into the owner's mouth without washing the hands, and when the dog is permitted to sleep in his master's bed with him, then the danger of infection is always present.

A characteristic of the tapeworm is that it lives within the intestines of various animals. Some demand a certain definite animal in which to live, others, again, are not so particular and are able to live and multiply in many different animals. Still others must have a certain host in the early stages of their life. If this is not provided, they die.

NATURE OF THE TAPEWORM

WHEN fully developed the creatures are usually elongated, flat, ribbon like, the front part being provided with hooks and sucking cups, their number and arrangement differing with the species. Mouth parts are lacking, food being absorbed through the walls of their body. The digestive juices of their host have no effect on the parasite, as they give off anti-ferments. Each mature segment of the tapeworm contains both sexes, and each segment with its fully developed eggs is thrown off, new segments being developed below the neck of the tapeworm. The discarded segments do not contain the sexual organs any more, but are filled with eggs. After the eggs have emerged, further development can only take place if the eggs are taken up by another animal. The embryo is freed from the egg by the digestive juices of the new host. Here the young tapeworm burrows through the body, encysts itself, and becomes passive, remaining in its position until taken up by another host, where the adult tapeworm then develops.

DO you know that dogs transmit diseases to man? Some parasites which infest dogs not only live upon animals, but will also thrive upon human beings if the proper precautions are not taken. This article tells how to recognize the symptoms of the different diseases in dogs, and how the animal can be cured with the proper treatment and care. Mange and tapeworms are undoubtedly the most prevalent parasites which infest the dog, and which also are transmitted to human beings. If your dog is affected with either of these parasites, he may be cured by following the directions given here. Cleanliness is of primary importance and will do much to prevent disease and infection, and check its spreading.

As many as 5,000 eggs are contained in a single segment of the pork tapeworm which also goes over to man. With such fecundity it is surprising that the worm is not more prevalent than it is. But the intermediate hosts necessary for their well-being and the other natural causes of their death before maturity brings it about that only a very few out of a million eggs ever reach the adult stage.

INDICATION OF PRESENCE OF WORMS

THERE are many symptoms which indicate the presence of worms in the dog, but all these symptoms are not always characteristics of worm infestations. They may be due to other causes as well. Only where worms or worm fragments are found in the stool is the presence of worms a certainty. Some of the other symptoms showing the probable presence of tapeworms are irregular appetite, poor digestion, diarrhea, undigesting food particles are excreted, and, at times, the dogs do not seem to thrive, they are emaciated and the hair is without luster. Pups infested with worms show cramps, fits and nervous disturbances. They snap at their stomach, run restlessly about, cry out and have passing disturbances resembling appendicitis.

DOG TAPEWORM MOST DANGEROUS

THE dog tapeworm (*Taenia echinococcus*) is the most dangerous. This creature seldom exceeds two-fifths of an inch in length and it consists of a head, a neck and three segments. It is found the world over. This tiny animal is also dangerous to man through its bladder worm stage. In Iceland where the dog is used as a working animal and is constantly in contact with man, one-tenth of the population die through sickness

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caused by this bladder worm. The tapeworm, of which this bladder worm is the intermediate stage, does much damage to its dog host, and all the symptoms of the dog are transferred to man when intimate contact with the dog takes place and an egg of the tapeworm is accidentally swallowed and so finds entrance into the stomach.

Although the tapeworm (*Taenia solium*) is usually found in the muscles of the pig, it also occurs in the dog and in man. In man it attacks the brain and the eye. When fully developed it is found in the intestines of man. Infection is usually made through the meat of infested pork insufficiently cooked. About 50,000 eggs are found in each segment. The usual number of segments is 800. This tapeworm may attain an age of 10 years.

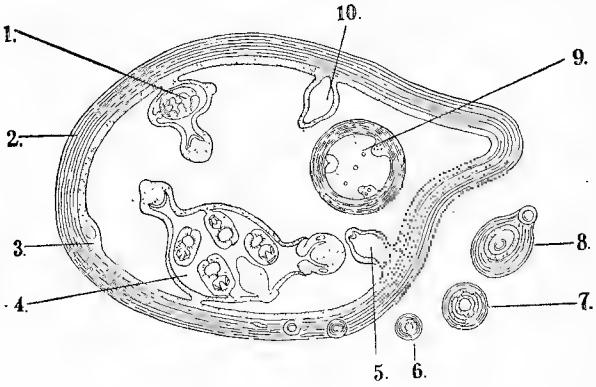
One of the common tapeworms of the dog is *Dipylidium caninum*, the common double-pored tapeworm and D. *sexcoronatum*, the six crowned double-pored tapeworm. These are also known as pinworms, although dogs do not have them, the larval stage being passed within the body of biting lice and fleas of the dog. Within this insect the tiny bladder worm is developed and if the dog eats these infested insects due to the annoying itches they produce, the tapeworm develops. This tapeworm also occurs in man, but more especially in children, as the result of accidentally swallowing infested fleas or lice.

CURE FOR TAPEWORMS

THE cure for tapeworms consists of a diet, a drug to kill the worms and a purgative. At times two or more of these effects are obtained from one drug. Freshly ground areca nut, the seed of a palm, is much used for dogs. Arecoline hydrobromide, obtained from this nut, is much used today. A dose, for a small dog, consists of ⅛ of a grain. For a medium-sized dog, ¼ grain and ½ a grain for a large dog. The treatment is given in the morning, food having been withheld during the night and no food is given for three hours after dosing. No purgative is required as the drug itself acts in this capacity as well. This treatment is safe in the majority of cases. Smaller doses must be given to weaker and sicker animals. In this latter case it is advisable to call in a veterinarian, for the giving of drugs is always a more or less dangerous task.

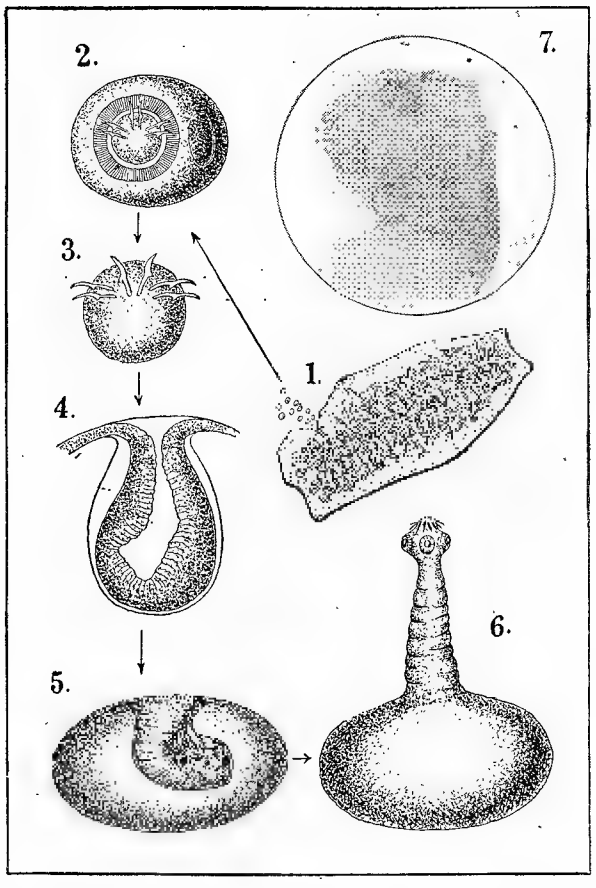
ROUND WORMS BAD FOR PUPS

THE round worms or ascarids are especially dangerous to young pups. After the eggs have been passed out, they must remain in the open a certain length of time, heat and moisture being especially favorable for their development. If such an exposed and developed egg is then brought into the stomach of dog or man, the embryo begins to develop. The eggs may enter the stomach through food or water. The young worms pass through the walls of the digestive tract into the blood and into the lungs and the liver. Here they leave the blood, enter the air passages, and are again swallowed, developing further in the intestines.



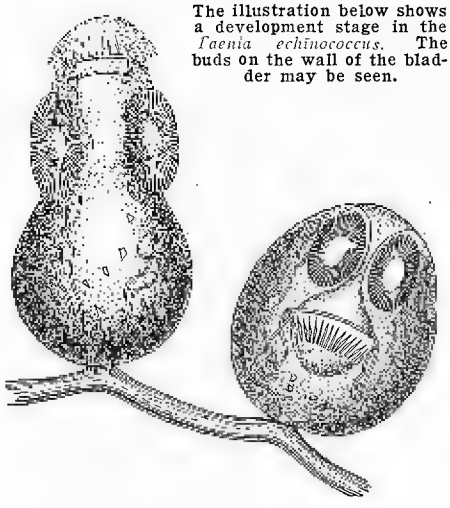
At the left is a diagrammatic sketch of the development of the echinococcus bladderworm. 1, 4, 5 and 10 show the various stages in the formation of the larvae cells. 2 and 3 indicate the cell walls of the bladder. 6, 7 and 8 show the outward development of the daughter bladders and 9 shows a young daughter bladder within the old bladder.

One of the most effective remedies for the removal of ascarids is the oil of the American wormseed. One fourth of a fluid dram or one cubic centimeter in a gelatine capsule for a dog weighing 22 pounds is used. Proportionate quantities are used for dogs weighing more or less. Immediately after dosing the dog, castor oil, one fluid ounce, is given. The dog may vomit,



The illustrations at the right show the stages in the development of *Taenia solium*. Fig. 1 shows the segments filled with eggs, some of which are escaping. Fig. 2 is the enlarged egg with the embryo; 3 is the free embryo. Fig. 4 shows a growing inverted bladderworm without head or suckers. 5 is a larva of the bladderworm, without hooks and suckers. 6 is a full grown bladderworm after the head has projected, and Fig. 7 is the head of *Taenia solium*, the tapeworm. All stages have been enlarged.

but in spite of this all worms will be killed. If the bowels do not move after 4 or 5 hours, another dose of castor oil should be given. When-even possible the cure for worms should be in the hands of a veterinarian to prevent accidents, for the oil may prove dangerous and even fatal to the dog. Then, of course, other methods must be used to remove the worms.



The illustration below shows a development stage in the *Taenia echinococcus*. The buds on the wall of the bladder may be seen.

MANGE CONTAGIOUS

ONE other common disease of the dog is easily transmitted to man through carelessness and close contact. This is the *mange*, more properly called the *sarcoptic mange*, which occurs all over the body. This disease is caused by a creature known as the mange mite, *Sarcoptes scabiei canis*, a relative of the spiders, the largest being less than 1/50th of an inch in length. These mites burrow into the skin and due to the irritation set up, a serum is exuded which dries and forms a scab, intense itching being felt at the same time. When the dog scratches itself, the scab is torn off, the sore being exposed and bacterial infections finding an easy entrance, these add to the inflammation and injury. If the disease goes unchecked, the dog may die within two or three months.

The cure consists of a health-building diet and the rubbing of the affected parts, after clipping the hairs, with any of the various ointments on the market. A mixture of one part oil of tar, and one part petroleum and six parts liquid petrolatum may be used. Or, ordinary sulphur ointment, which consists of one part flowers of sulphur and eight parts lard mixed together is of use. Whatever type of treatment is given, the dog much be prevented from licking the applications either by broad collars or muzzles. At the same time the bowels must be kept open and the animal protected from colds.

No matter what particular kind of a disease the dog may have, which may or may not be transmitted to man, cleanliness and disinfection is necessary. All litter should be burned and the kennel, dog house and bed should be thoroughly cleaned and then disinfected with strong coal tar disinfectants.

Dogs should be given a bath at least once a week, especially in the warm weather. Adding a little kerosene to the water will help in killing any lice or other insects which may be hidden in the hair of the animal. Cleanliness is of primary importance where house pets are concerned. Tapeworms and mange may be transmitted from the dog to human beings. Of all parasites which infest dogs, probably the worst are the numerous types of tapeworms. When the dog is permitted to lick the face, when he is kissed and petted, the danger of infection is always present and should be guarded against at all times.

Nothing said in this article is intended to alarm the reader. The dog is one of man's best friends and his faithfulness has been celebrated in prose an poetry. He is well worth the care suggested here.

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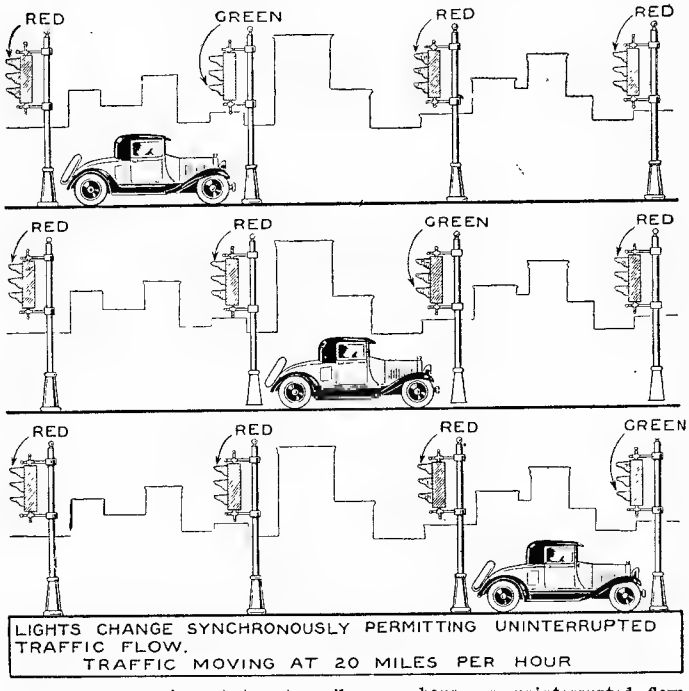
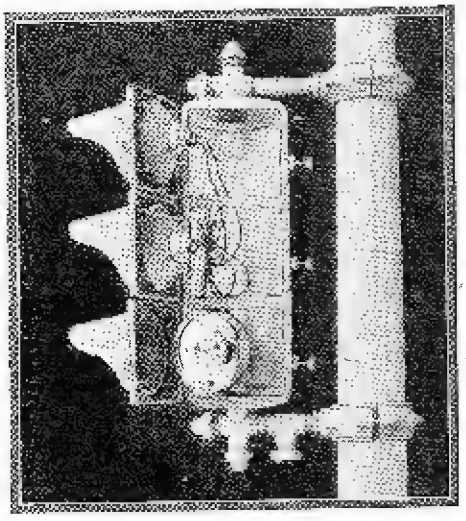
Cars Keep Moving With New Signal

A MOST ingenious type of manless system of traffic control is now being used in parts of New York City, Chicago, and St. Louis. The system, which was developed by the General Electric Company experts at Schenectady, will direct traffic without the intervention of human aid. It was first placed in operation sometime in January, 1928. It is the most up-to-date and one of the largest installations of traffic signals using the synchronous control system for the progressive flow of traffic. By means of this arrangement, the signal changes at each intersection are so timed that a green or "go" signal shows progressively up and down the road and allows a vehicle to maintain an average speed of twenty miles an hour without stopping at any intersection. The equipment consists of four one-way vertical brackets, mounted upon the far side of each intersection and regulated by synchronous control boxes. There are seventeen intersections on the street and two other intersections on a boulevard, all of which are timed to form one uniform synchronous traffic artery. The synchronous motors, which are placed in an iron box mounted on each signal support, are connected directly to the nearest light line and operate a synchronous timer. The synchronous motor is running at all times, and its speed is governed by a revolving disk. The new system of regulating traffic also controls the flow of vehicles on the main and cross streets, and also provides a left-turn signal, so that vehicles may turn left without crossing streams of traffic coming from the opposite direction.

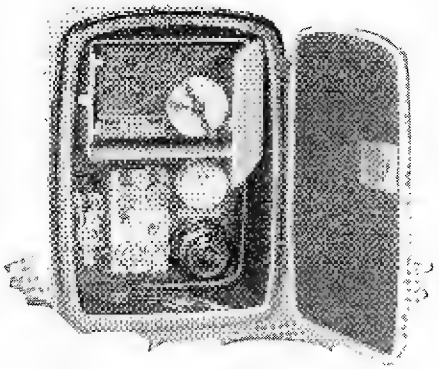


With traffic moving at twenty miles per hour, an uninterrupted flow is permitted, due to the fact that the lights change successively, as illustrated above.

If a vehicle enters the controlled zone at a time before or after the period of traffic flow or progression, it may be stopped at the first intersection. However, upon again starting and keeping a speed of twenty miles an hour, it will be able to continue without further interruption. This is true regardless of whether the vehicle enters the controlled zone on the main street or from a cross street. In order that operators of vehicles and pedestrians may be acquainted with the colored signal lights, signs are installed at each end of the street and at the principal cross intersections. Where traffic is extremely dense, all the signals along the street may be set to flash red or green in unison, and where traffic is rather light, an uninterrupted flow may be permitted. A special jack or switch has been provided in the central box, and when this is turned all the lights show red. Traffic is stopped in this way in order to permit the passage of fire engines or an ambulance. From control headquarters or the central office, an operator can press a button and stop traffic on any street desired, or stop traffic throughout the section where the "automatic policemen" are installed.



Above is a photograph of a three-color one-way vertical bracket type of traffic signal, mounted upon a short arm bracket. The doors of the signal have been left open.

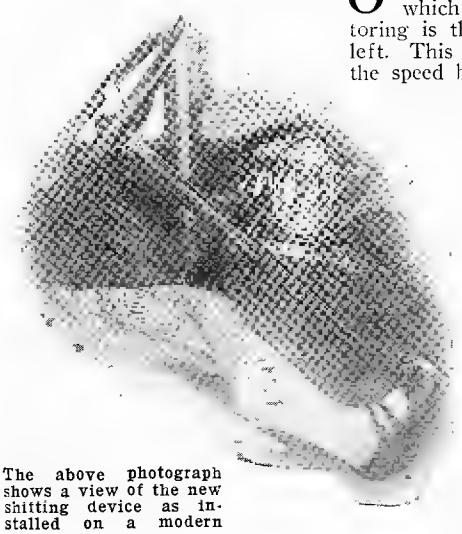


One of the cast iron mechanism boxes housing a synchronous timer is shown in the above photograph.

Is it not possible that the scientists at Schenectady will add an attractively uniformed "televox" to the system to carry out the illusion of a policeman?

NEW SHIFT METHOD

ONE of the newest inventions which will aid in better motoring is the device shown at the left. This is a method of changing the speed by means of a progressive shifting device mounted to the right of the steering post. This lever is simply pulled out or pushed in to shift gears and consequently change the speed of the motor vehicle. The brake may be seen being operated by the right foot of the driver. With this new arrangement, considerable space and room is gained in the driving compartment, and exit and entrance can easily be gained through the door to the left of the driver.

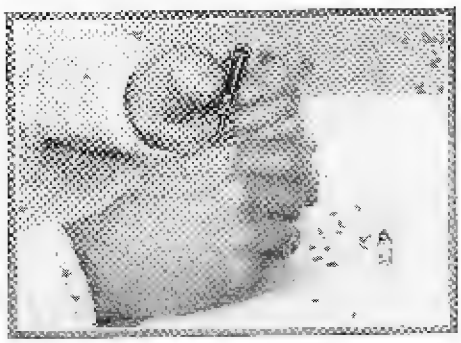


The above photograph shows a view of the new shifting device as installed on a modern motor car.

ANTISEPTIC APPLICATOR

ONE of the latest developments in antiseptic application is a device which feeds the solution much the same as a fountain pen. A glass ampoule is filled with the antiseptic solution and has one end drawn out to a point so that application can be made where desired on the cut or wound. Each is packed in a wooden container and contains mercurochrome or iodine. When using the applicator one simply has to remove the rubber fitted cap and touch the point to the skin, obtaining a clean line or patch of antiseptic. Each bottle will make a line of solution fifteen feet long and one-fourth of an inch wide.

Name of manufacturer furnished upon request.



The above illustration shows the new applicator for antiseptic solutions. The device consists of a glass tube which feeds the liquid as easily as a fountain pen.

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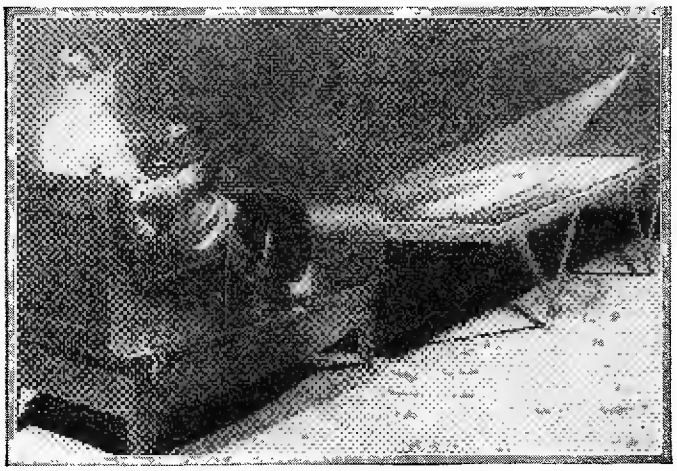
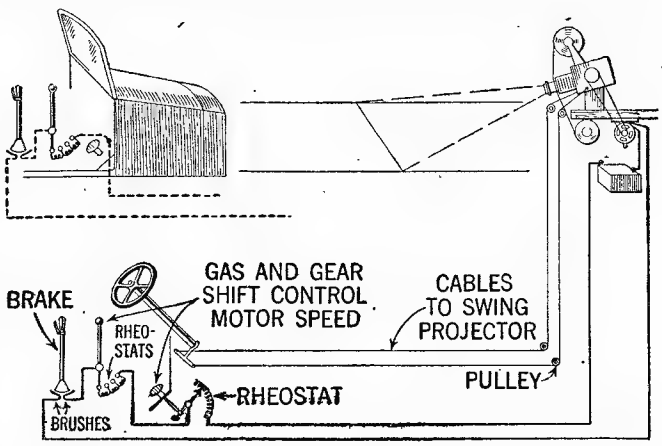
MECHANICAL DRIVING INSTRUCTOR



The above photograph shows the new mechanical device which helps to instruct one in driving a car. The picture was taken at the Dresden exhibition.

A NEW mechanical invention for teaching one to drive an automobile was recently exhibited at an exhibition held in Dresden, Germany. The usual type of automobile driving seat and steering wheel are used with the conventional type of brake, shift lever, and accelerator. The embryo driver takes his place in this dummy car as shown in the photo. A motion picture projector is started and street scenes are thrown in front of the driver on a raised screen. The screen support resembles a long table and is covered with suitable cloth for projecting the pictures. This may be clearly seen in the illustration. The picture projector is placed at the far side of the screen opposite the driver. Pictures of various street scenes move and approach the car. The new driver has to "cross" the streets without failure.

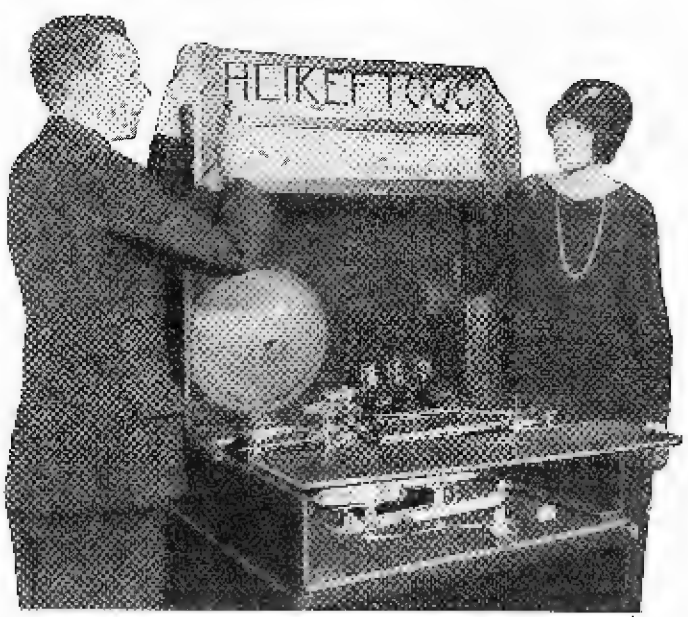
By referring to the schematic drawing it will be seen that the gas and gear shift control the speed of the motor on the picture projector, a resistance being used with each as shown. The brake is arranged to act as a switch and starts or stops the motor. The steering post is attached to the projector by means of cables which operate on the projector, swinging it when the steering wheel is turned. Thus the driver has the means at his disposal for starting and stopping and in short can do everything with the dummy car that can be done with a regular automobile. Ordinarily the car moves, but with the mechanical instructor the auto stands still and the road moves past. It is claimed that the new driving instructor teaches in one-half the time usually taken to learn. Beginners taught in this manner find no difficulty in maneuvering in traffic, even for the first time. We may envision the driving school of the future with a number of booths or rooms each having a dummy car and picture projector. With one-half the time and with the elimination of much bother and worry one will learn to drive expertly in traffic in a few days.



The manner in which the device works is shown in the above illustration.

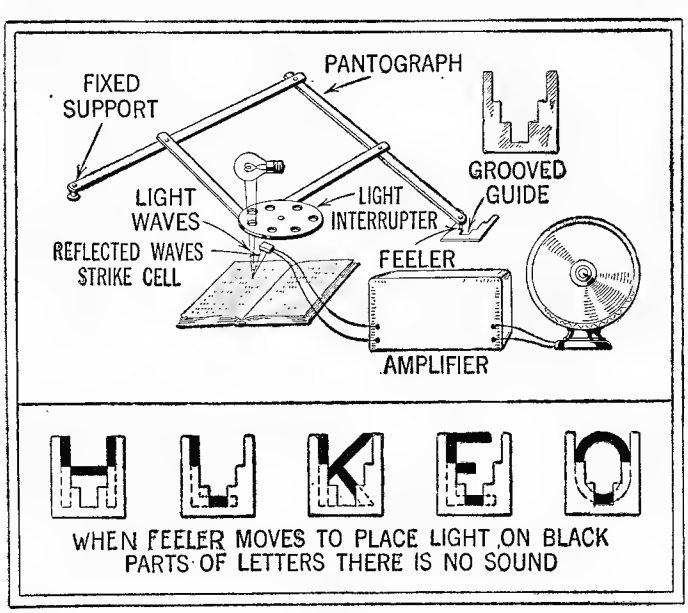
NEW "EYES" FOR THE BLIND

A NEW invention for helping the blind to "see" has recently been made by Robert B. Naumberg and is known as the Visagraph. It enables a blind person to read any printed matter and was developed by a series of experiments made during the last eighteen months. The Visagraph only asks the reader to distinguish between a buzz and silence, or between vibration and no vibration, any intensity of signal being used. A grooved guide is provided which has five steps. These are sharply defined, although they are only one-sixty-fourth of an inch high. The blind reader moves the feeler over these steps which tell him what portion of a letter he is on. If a buzz is heard in the speaker or phones it indicates a white portion, and if nothing is heard it indicates black. From this combination of information from the two sources he mentally reconstructs the shape of the letter. Of course he does not trace the entire letter because certain characteristics are all that are necessary. When in use the printed matter is placed in a holder and a light ray about five one-thousandths of an inch in diameter is projected down onto the printed page. A selenium cell is provided to pick up the reflected light rays which are correspondingly changed into electrical impulses. This needle ray device is mounted upon a pantograph. In forming the letter H the operator begins at the left-hand side of the grooved guide and draws the feeler down over the strips. As he does that the light ray on the other end of the pantograph traverses the black line on the left leg of the letter. There is no sound, so that the operator knows he has struck a part of the letter. Then he moves his rod slightly to the right and draws it straight down. A buzz is heard all the way down, except for an instant of silence in the middle. No letter but H is similar to this, so he readily recognizes it. The operator reads the other letters in the same manner, and as practice is acquired various short-cuts can be employed, by which he may identify a letter without tracing it.



The above photograph shows a blind student demonstrating the Visagraph to the wife of the inventor. This device holds great possibilities for the blind.

At the left is an illustration showing how the Visagraph works. The blind reader moves the feeler over the guide, and the signal from the speaker tells him if he is on black or white.



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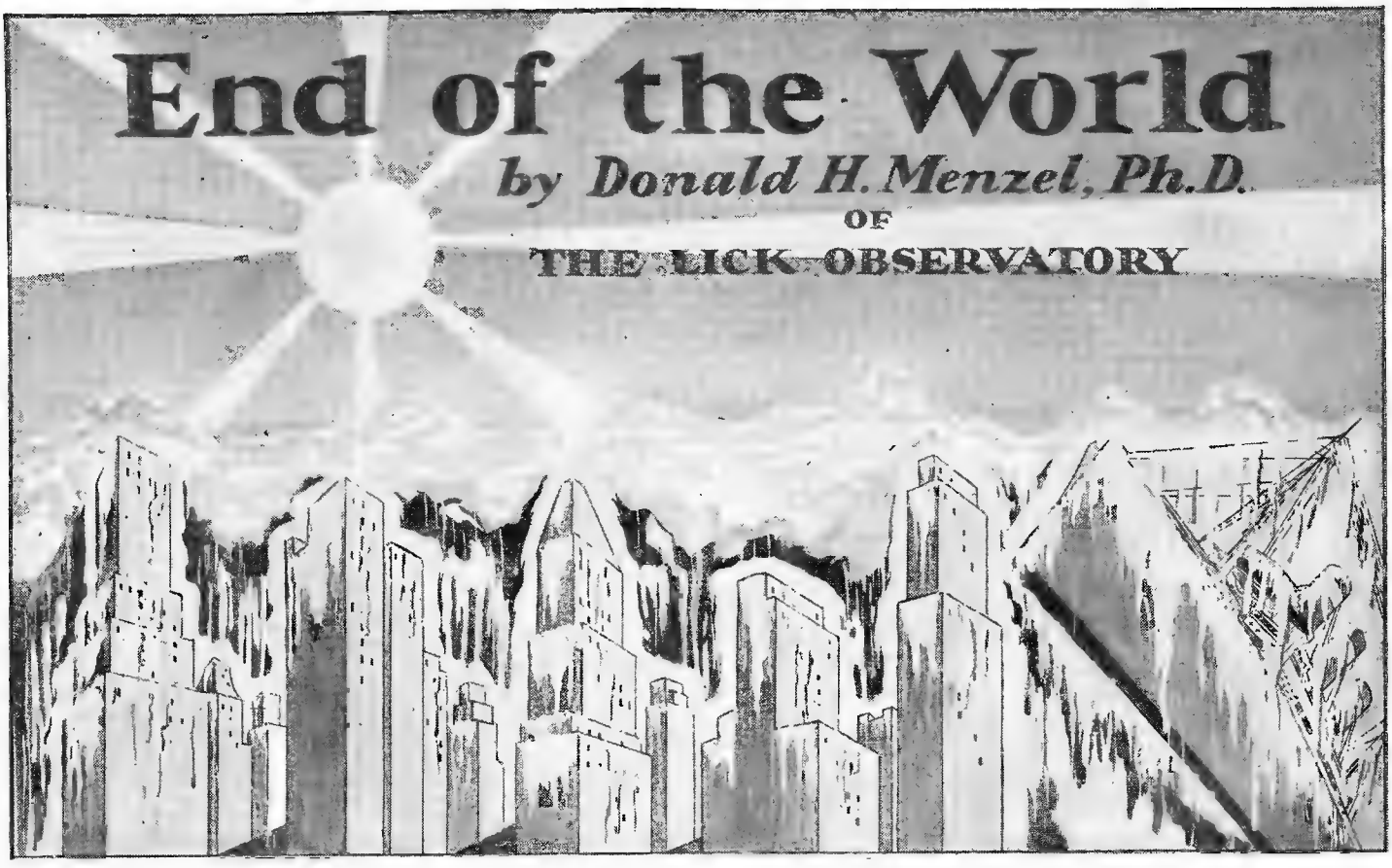
End of the World

by Donald H. Menzel, Ph.D.
OF
THE LICK OBSERVATORY



The picture above shows how the buildings and even ocean liners would be covered with a veritable ice cap if the sun's power should fail. The sun would glow like a pallid ball but the heat received would be insufficient for our needs. The food question would probably be the greatest one to be faced by people caught in such a catastrophe. Completely insulated houses might help to save the lives of the people, for a time at least.

WHEN will the world come to an end and how? While, of course, we could do nothing in any case to avert such a catastrophe, most of us would like to be assured that the event will not occur at least within the next few hundred years. Various scientists have risen to the occasion and have quieted our fears by telling us that, in all probability, the sun will continue to shine as at present for many billions of years to come. Their scholarly calculations will come to naught, however, if we are to accept the new theories just propounded by Dr. J. H. Jeans, famous English astronomer, physicist, and mathematician, who avers that our sun is on the verge of instability; that its collapse into a feebly luminous star may begin at any instant.

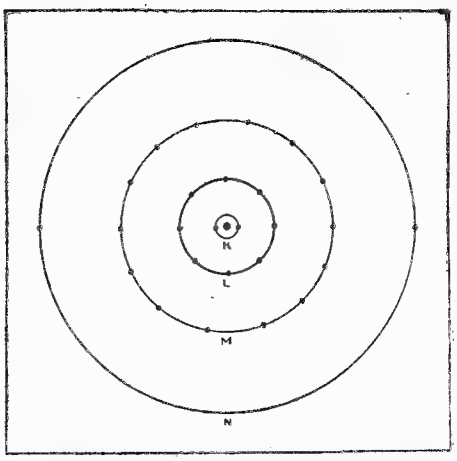
POSSIBLE CAUSES

THE end of the world! Authors of fiction have pictured in vivid terms a blazing comet crashing headlong into the earth. A huge fiery meteor would cause terrific havoc if it fell in a densely populated part of the globe. Suppose another star were to collide with our sun; the intense heat accompanying the catastrophe would undoubtedly be great enough to destroy all terrestrial life. The sun is radiating heat continually into space, and, since the source of energy cannot be unlimited, the sun must eventually cool off—to become a cold, dead sphere, faintly illuminated by starlight. There is also a chance that, before this happens, the sun may explode, as many stars are observed to do, becoming what astronomers term a "nova."

None of the aforementioned catastrophes are impossible, but the cautious astronomer assures us that none of them are imminent. In 1910 the earth actually went through the tail of Halley's comet, but even had we struck the head, probably little more than a brilliant meteor shower would have resulted. Judging from past performance, we have conservatively estimated that the sun will continue to furnish light and heat for billions of years to come. Stellar collisions are certainly improbable. Since we do not know exactly why stars explode, it is difficult to say much about the subject, but as a good guess, based upon the number which have this experience annually, the chances are about even that the sun will become a nova sometime within the next billion years. In the face of this scientific reasoning, then, what new ghost has Jeans conjured wherewith to terrify us? Can the figures given above be in error? It is possible, for astronomers are by no means infallible. While, in our calculations, we employ the very best of theory available at the time, any discovery which may upset the foundations is sure to destroy the value of the results based thereon.

LIFE HISTORY OF A STAR

DR. JEANS describes the life history of a star according to his conception. But first let us see what his theory, or any theory, for that matter, must account for. When we consider the universe as a whole, our sun sinks into insignificance. It is just one among many billions of stars, some brighter, some fainter, some larger, some smaller than our sun. Each of these stars is pouring out vast quantities of light and heat into empty space. Since we cannot logically believe the store of heat within a star to be infinitely great, we should reasonably expect to find the star altered by the passage of time.



The diagram above shows the structure of the iron atom. The new theory of the sun's collapse is based on a study of the electron structure of the iron atom here pictured.

It is thus that we conceive of the "birth" or "death" of a star, but we have yet to discover the changes it undergoes during its life. Stellar evolution is unquestionably slow; geological evidence proves that the sun has changed but little during the past billion years. What chance, then, have we, in our ephemeral existence, of discovering how a star acts during the course of its life.

Strange as it may seem, the task is not hopeless. To utilize Sir William Herschel's illustration, I may say that the situation of the astronomer is not unlike that of an observing person spending a day in the woods. About him he may find sprouting seeds, saplings, sturdy oaks, fallen trees, decaying stumps, mould. Though he may not see even so much as a single leaf unfold, he may very logically piece together his observations to discern the life history of a tree. The heavens are full of stars, presumably in all stages of evolution, and the astronomer should be able to reason similarly.

DR. JEANS' NEW THEORY

THE various theories existing hitherto all have pictured a star as evolving gradually, slowly changing its constitution from birth to death. Jeans discards this idea not merely as unnecessary, but improbable. He points out that the stars themselves do not fall in a gradual sequence like the trees of our analogy. There appear to be three distinct groups of stars. The first consists of huge, tenuous objects with average densities somewhat less than that of ordinary air. The second group, of which our sun is a

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member, contains fainter, smaller stars about as dense as water. Very few stars belonging to class three have been discovered; these are extremely faint and dense—a cubic inch of the material composing them would weigh a ton.

Each individual sun is composed of atoms which are, according to Jeans, packed quite closely together in the stellar center where the pressure is simply enormous. These atoms act as a sort of framework to support the outer layers of the star.

Physicists have shown that the atom is far from solid. In the center there is a heavy massive nucleus, about which many planetary electrons are circling. In the accompanying diagram of the iron atom it will be seen that its 26 electrons are distributed, not at random, but in various groups or rings about the nucleus. The figure is a schematic not an actual picture of an iron atom, which is not flat and circular, but more nearly spherical, its concentric rings being expanded into concentric shells.

ELECTRON THEORY AS RELATED TO STARS

IRON, as we know it, has two electrons in the innermost or K shell, eight in the next or L shell, fourteen in the M and two in the N shell. In the hot stars, however, the atoms are tearing about with such tremendous velocities, crashing into each other thousands of times a second, that many of their electrons are lost in the fray. Dr. Jeans has calculated that in the giant stars, the first group mentioned above, such conditions of temperature and pressure prevail that the average atom will have lost all of its electrons down to the M shell, which will still be more or less intact. In the hotter stars, however, atoms are more severely abused; practically all of the electrons outside of the K shell being torn off. These atoms are, of course, much smaller than those of the giant stars and the stars themselves permit greater compression. The calculations, continued, show that in stars of the third group conditions are so extreme that the atoms are stripped bare of all electrons, only the nuclei remaining.

Here, then, is a sequence—a sort of evolution. We may picture the star, new-born from the nebula or whatever primal stuff that forms it—huge, so rarefied as to be little more than a vacuum, glowing faintly red. Under gravity the star contracts, getting hotter and hotter with the compression. The M shells of the atoms finally jam fairly close together and a giant star results.

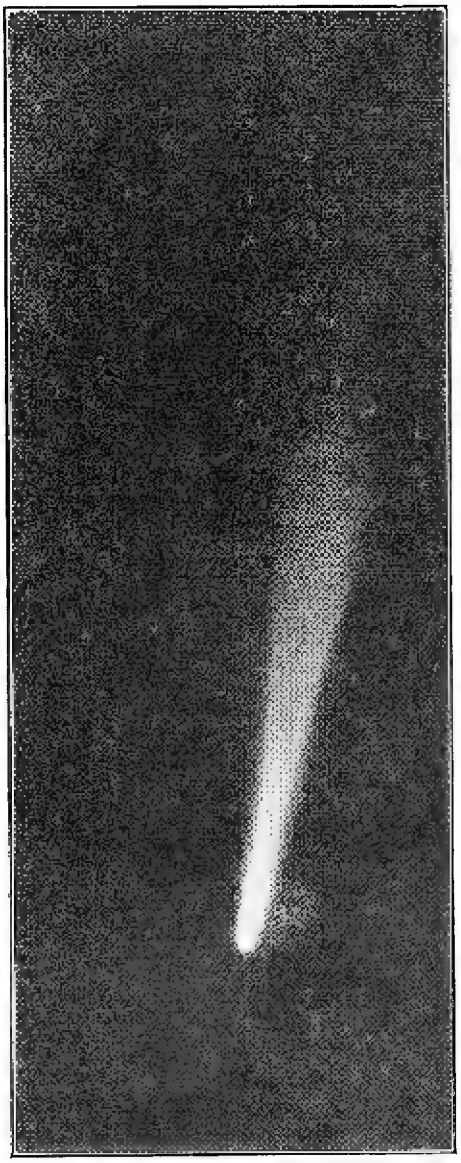
HOW STAR COLLAPSES

THIS semi-stable state probably persists for billions, perhaps trillions of years, and then something happens. The stellar center has, in the meanwhile, become so hot that the atoms are being torn asunder. The last electron is wrested from the M ring and the shattered atom can no longer support the tremendous weight of the overlying layers of the star. Like Samson's temple, the star collapses.

The star now contracts gravitationally until, this time, the K rings are jammed to form the supporting stays. The greater number of stars in the second group suggests that evolution proceeds more slowly at this point, but finally the K shells, too, must be disrupted and the star collapses again into a faintly luminous type three object. The foregoing theory certainly accounts for many of the observed facts, but the reader must be warned against accepting it unreservedly. The entire field of stellar evolution is embattled. Protagonists of the respective theories are taking friendly potshots at each other from their entrenchments, and it is far too early to predict the outcome of the struggle.

Yet the rival theories have many points in common. One of the startling conclusions, first announced by Jeans, is the aforementioned precarious situation of our sun, somewhere near the lower edge of group two. It is impossible as yet to say when the predicted instability will arise, and just how the sun will behave during its collapse. But the fact remains that we can no longer take the sun's constancy of the last billion years as a future guarantee of safety, for each added year must bring us closer and closer to the abyss, where the sun will be plunged into instability. It is probable, however, that ample warning will be given.

DR. J. H. JEANS, famous English astronomer, has evolved a new theory concerning the life history of a star. You will find the accompanying explanation of his theory by Dr. Menzel, well-known American astronomical authority, very interesting. Some years ago, when scientists first began to learn about the electronic structure of the atom, no one thought that this bit of science would be used to evolve a brand new theory as to how stars grow and collapse. Every student of physics will, therefore, find this new astronomical theory of star formation and evolution particularly interesting, based as it is upon the rather simple behavior of the electrons composing an atom.



An excellent picture of Halley's comet. In 1910 the earth actually went through the tail of this comet without any serious results.

EARTH A FROZEN WASTE IF SUN FAILS

MANY of us have seen moving pictures of a growing flower—the graceful gesture with which a tulip throws out its bud made manifest in a fraction of a second. We have been discussing in much the same way the life of a star, and we must remember that on the true time scale, the precipitous collapse of the star may relatively be far less rapid than the budding of the flower. We and our near descendants are probably in no imminent danger, but nevertheless a short time, possibly only a few millions of years, may find the earth a frozen waste—the sun a pallid ball still a thousand or more times as bright as the moon, but shining too feebly to make its warmth felt on the earth. I should like to close with a little allegory which appears to be particularly appropriate . . . Once upon a time there lived a race of *ephemerids* within the glass tube of a thermometer. In spite of the fact that their span of life was but a fraction of a thousandth of a second, they felt no inconvenience since their mode of existence was proportionally accelerated. Thinking and reasoning much as you or I, the scientists of this race discovered that the mercury of the thermometer tube was rising a ten thousandth of an inch per second. After so many generations had passed that this result had become an established law of nature, one of their leading scientists calculated the exact moment when the mercury, reaching the top of the tube, would burst its confines and destroy all life. As the predicted day grew nearer the *ephemerids* bemoaned their fate until one of them suddenly thought to remeasure the value. He was astonished to find that the mercury had ceased to rise; it was, in fact, going the other way. It is reported that a thanksgiving and holiday was declared, dedicated to the kind and merciful providence which had reversed a law of nature so as to save them from destruction.

What will the inhabitants of the earth do if a catastrophe such as here described should take place, and the warm rays of the sun diminish in strength? Many fiction stories and philosophical deductions have been phrased by both poets and scientists; the large picture on the opposite page shows one of the effects bound to occur if the sun lost its power to send us sufficient heat. An intense cold would grip the earth and ice would cover our cities and towns. It might be possible for awhile for the inhabitants to procure sufficient fuel to heat the buildings and possibly keep some of the highways open. After a short reign of this severe cold, however, the inhabitants of the earth would probably be driven to seek an abode in dug-outs or subterranean chambers. Unless some new form of food was discovered, however, crops could not be grown, and famine would doubtless soon claim the majority of the people. Aside from the food question, we could probably keep warm for a considerable period, as oil, natural gas and coal fuels could be extracted from the earth and distributed through underground channels or over the top of the ice. The nearest approach to such a condition in our day is found in the north and south polar regions. In the northern regions, the Eskimo thrives in a very healthy manner. However, in such a case as the present discussion discloses, a very severe cold of which we have no conception, would doubtless soon spell the end for the earth's inhabitants.

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Distorted Perspectives

$5.00 for Odd Photos of Distorted Perspectives

The photograph below gives one a bird's-eye view of the subject. This is in great contrast to the worm's-eye view shown in the picture at the left. This photograph, taken by Frank Gighotti, was made by pointing the camera down upon the subject. Views of this nature are comparatively easy to make and result in many freak effects.

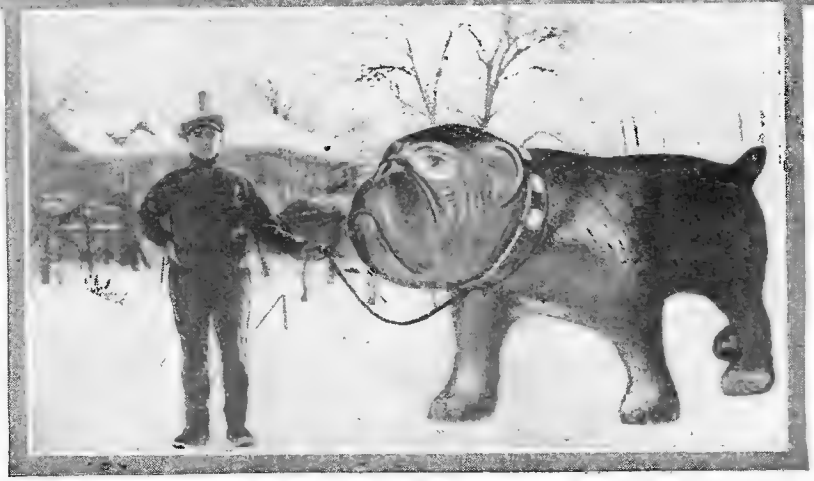
Above photo was taken by R. E. Westbrook. The bathing beauty was reclining.

Can you figure this one out? The above photo shows Johnnie Farrell demonstrating some of his strokes on top of a high glass platform through which the picture was taken. This view is unique in the fact that the stance of the golf "pro" can be studied from an angle never before possible. Given this hint, what can you, our readers, do? Glass plates can be used in many ways for producing freak photographs.

No, the above is not a circus freak, but simply a freak picture.

A most novel photo is that shown above. It was taken with the aid of a convex mirror and shows how scenes can be distorted by this expedient. In this particular case the mirror used was about 18 inches in diameter and was placed in an almost upright position a few inches above the floor. The camera was positioned slightly to one side of the center and so adjusted that the reflection in the convex mirror nearly covered the plate which was used. Mr. James Alta is the photographer of the above example of distortion.

The above photo is a good example of what can be done with a camera placed close to the subject. This picture of a buffalo was taken by Mr. A. J. Jacobson, of Duluth, Minn. Even though the picture is unnatural, due to its distortion, it will be noted that the details are remarkably clear. An ordinary camera can be used in taking all of the distorted photos shown upon this page, no special equipment or lenses being necessary. The photograph at the right, although taken with an ordinary camera, calls for a copying lens and special processes in the finishing of the picture.



The photograph above was taken by George Hirshman, with an ordinary camera, and gives the effect of one foot being larger than the other. The unusual photograph at the left was made with three exposures. The first print was made of the young man with his hand extended. The second print was that of a dog of small size made of celluloid. The third print is a copy of the first two which was made with the aid of a copying lens fitted on to an ordinary Kodak camera. The dog was first cut out and pasted on the print of the young man and a rope drawn in with ink, as shown. After this was done, the picture was rephotographed, producing the unusual effect shown here. This photo was contributed by Walter Rudnick.

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THE UNFINISHED RADIO

An Absorbing Tale of Love, Radio, Inventions and Mysterious Kidnappers

By EDNA BECKER

"IF the new Sharkley tube is as good as it is reported to be, it will hit us pretty hard."

"I know it." The president of the Goreham Radio Corporation pulled at his moustache.

"What's the matter with us lately? Aren't our research men as good as theirs?" The vice-president looked concerned.

"Better. They haven't a man on their staff that can equal John Brent. But if he doesn't stop chasing this Gwynneth Harper and get down to business pretty soon, I'm going to fire him."

"Quit kiddin' yourself! Old Sharkley has tried to take him away from you too many times for you to play into his hand like that. Practically every idea we've used that has netted us anything has been his. He ought to shake this Harper woman, though. Why don't you talk to him?"

"I have. Several times! As for shaking Gwynneth Harper—well, men don't, that's all. I've left word for him to come in this afternoon. He ought to be here any minute. One thing is flat: he either gets to work or gets out. I'm about through."

At this moment Goreham's secretary entered. "Mr. Brent is here."

"Send him in. Better wait, Kline."

"Can't. Sorry. I'll drop in later and see how you made out."

At the door he met Brent, a little under average height, yet good to look at. He was immaculately dressed, and it was a rare occasion when one saw him any other way, even when he was working. A close observer would have noted that he seemed to be a contradiction of himself. His high, reflective forehead, and his almost dreamy dark eyes stood out in direct contrast to his jet-black hair that fairly bristled, and to his decided chin. There was an air of introspection about him, yet at the same time he was electric; one almost felt him when he was near.

After the door had closed behind Kline, Brent paused a moment till Goreham motioned him to a chair. Soon they were absorbed in a heated conversation.

Later in the afternoon when Kline came in, he found Goreham still at his desk tugging fiercely at his moustache.

"How'd you come out?"

Goreham scowled. "Nothing to brag about. Silly young jackass got hot under the collar. Said he had been working. Wants us to come to his laboratory tomorrow night."

"Humph! He hasn't done a thing and I know it. I talked to him yesterday. He needs drastic treatment. But you know, Goreham, I have a lot of faith in that chap. I'll bet he could eliminate static if he wanted to badly enough."

"Well I'm giving him one more chance, and if he doesn't snap into it, he's fired."

The vice-president's face clouded. "I'd hate to lose young Brent. Isn't there some way. . . . Let's think it over a little more."

For an hour the two men remained in close conference.

Brent, as a matter of fact, had a little device he had worked out, but his big idea, while crystal clear was still an idea.

ROBBERY

A FEW minutes before eight o'clock on the following evening, Brent's springy step sounded in the hall. When he paused before the door of his laboratory to unlock it, he was astonished to find it standing wide open. He pressed the light switch and saw that the apparatus he had set up for the demonstration was gone. He rushed to the drawer where he kept his notes, and they, too, were gone.

When Goreham came in a few minutes later, he found Brent in a high state of excitement, turning lockers and drawers inside out. "In heaven's name, man, what are you doing?" he shouted.

"Some dam' thief stole my apparatus and all my notes and drawings. They were here when I went out to dinner."

At this moment Kline came in.

"What's all the row about?" he demanded.

"Somebody's stolen Brent's notes and apparatus," said Goreham.

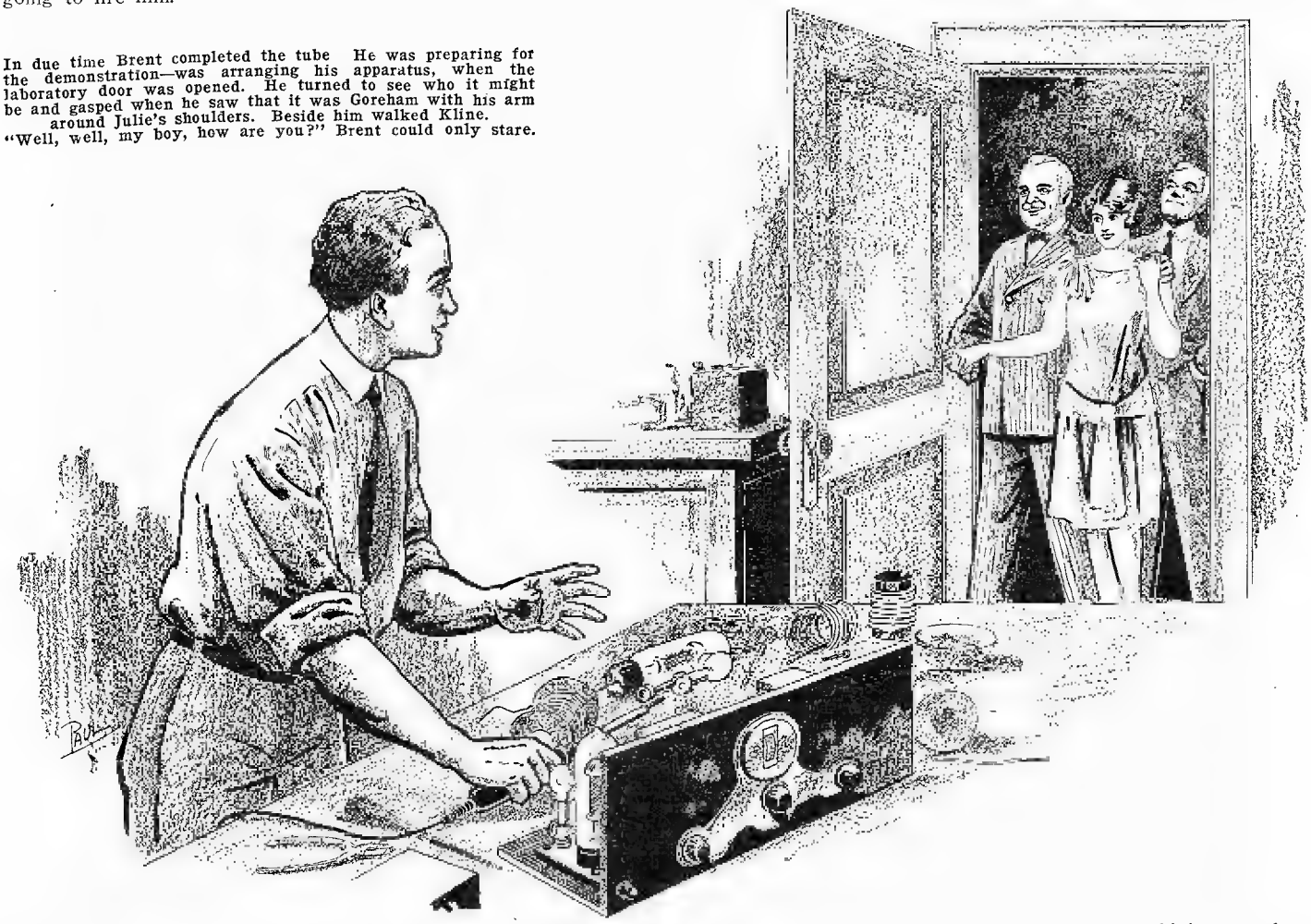
"Have the police been notified?"

"Not yet."

After Kline had rushed out of the room, Goreham turned to Brent. "How much do you think they can get out of your stuff?"

"Don't know. They won't get much out of the apparatus. What they were after was the dope on my new tube, I guess. Darn dirty trick."

"Rotten. Maybe they didn't get much after all. No one could make anything out of your notes." *(Continued on page* 555)



In due time Brent completed the tube He was preparing for the demonstration—was arranging his apparatus, when the laboratory door was opened. He turned to see who it might be and gasped when he saw that it was Goreham with his arm around Julie's shoulders. Beside him walked Kline. "Well, well, my boy, how are you?" Brent could only stare.

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Conducted by GEORGE A. LUERS

SPRING HINGES MAKE GARAGE DOORS SELF-CLOSING

The car can be quickly driven into the garage when it is raining, snowing or cold without need of the driver exposing him or herself, when the garage doors are fitted up as indicated in the drawing.

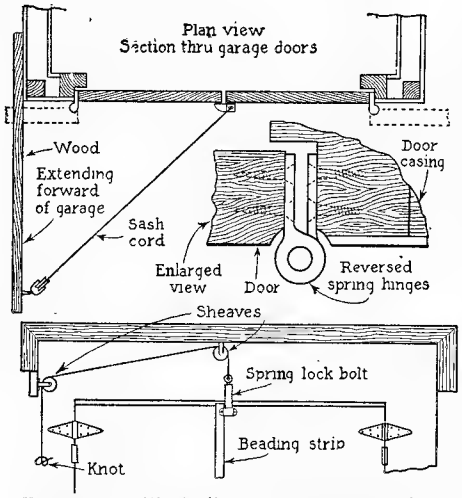
There will be required, to fit the doors with this quick-opening feature four spring hinges, of the screen door type, about twenty feet of sash cord, one spring type of lock bolt and two pulleys or sheaves for the cord to run on.

Invert the spring hinges, screwing these between the edges of the door and casing. This causes the doors to open when released.

Place the spring bolt above the door, with a sheave above this and another sheave about ten feet forward and to the left of the car facing the garage.

The second sheave is secured on a wooden beam nailed to the side of the garage. The sash cord is attached to the bolt, run through the sheave and terminates in a grip knot.

Pulling the cord, releases the bolt and the spring hinges open the doors. On the edge of the door which the bolt holds, is a strip or beading to overlap and hold the opposite door. This is shown in the sketch of the front of the garage.



The above illustration shows how spring hinges may be fitted to the garage doors in order to make them self-closing. Pulling the cord releases a bolt and the spring hinges open the doors. The hinges are inverted and are screwed between the edges of the door and the casing.

CORRECTING AXLE TILT TO PREVENT SHIMMY

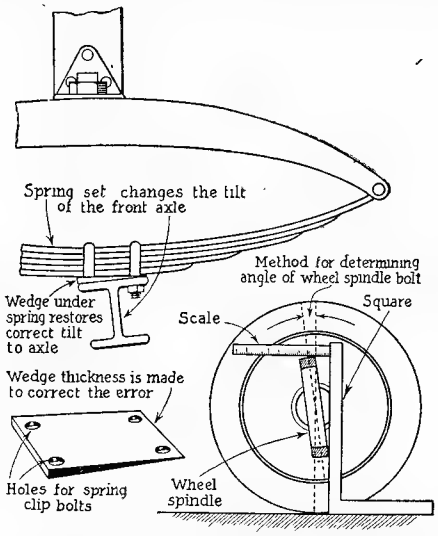
Apart from the annoyance of front wheel shimmy, there is much danger if this fault is allowed to develop in the car.

A correction for shimmy of the front wheels, which one large service station has applied with good results, is that of using small secured wedges to give the correct tilt to the front axle.

When the front springs of the car take a permanent set, the axle is tilted off the normal position. This distortion, which may be slight, cannot be detected by eye, but only by measurement. The usual tilt of the wheel spindles, is 5 degrees, but individual cars differ and the instruction book should be consulted or this information should be obtained from the manufacturer.

The measure of tilt is made with a large square and a scale, or more directly with a quadrant.

The wedge, as shown in the sketch, is readily made from sheet steel and bolt holes are provided to engage the spring clip bolts.


Spring set changes the tilt of the front axle
Method for determining angle of wheel spindle bolt
Wedge under spring restores correct tilt to axle
Scale
Square
Wedge thickness is made to correct the error
Holes for spring clip bolts
Wheel spindle

A car which gives unsatisfactory results due to wheel wobble can be readily fixed by using the above method. Small wedges gives the correct tilt to the front axle. The measure of the tilt is made with a square and a scale.

A car giving unsatisfactory results due to wheel wobble can be readily corrected by any mechanically inclined owner using this means.

The angle of the spindle bolt should be accurately checked before and after placing the wedges.

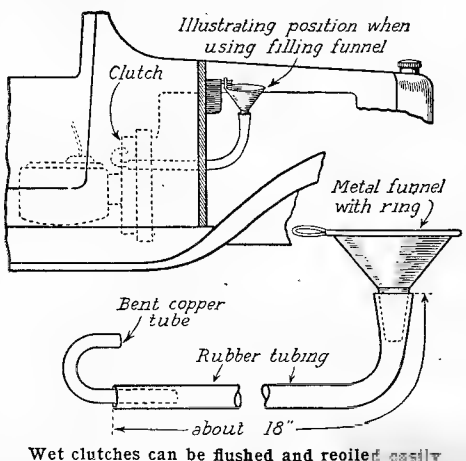
FLUSHING AND FILLING WET TYPE CLUTCHES

Neglect of a clutch of the wet type, to the extent of loss of lubricant through leakage, will invariably ruin the clutch.

With wet clutches of the Essex and Hudson type, it is desirable that these be flushed and reoiled each 750 miles or oftener.

The flushing is done with kerosene after draining and the clutch is then refilled with a half pint of kerosene and cylinder oil in equal proportions.

A special filling funnel for this use is shown by the attached sketch.



Wet clutches can be flushed and reoiled easily by employing the method illustrated above. In flushing the clutch, it is desirable to use at least a quart of kerosene.

DO YOU KNOW—

the starter grounds through the engine. Loose bolts with oil saturation around the starter bracket are causes of weakness in the starter.

This consists of a length of rubber tubing, a small metal funnel with a ring holder and a piece of bent copper tube.

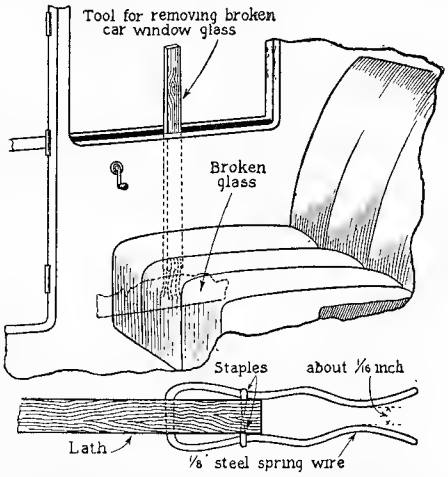
With this filling means, the flywheel containing the clutch housing is turned to a position where the tube on the end of the filler can be inserted.

The funnel ring can be hooked over any projection and the clutch filled.

In flushing the clutch it is advisable to use a quart or more of kerosene, which is easily poured with this arrangement. Owners who have previously attempted to use a squirt gun for clutch oiling will appreciate this new method when used.

TOOL FOR REMOVING BROKEN WINDOW GLASS

Glass breakage in the windows of the automobile, invariably results in one or more pieces falling down into the aperture into which the window lowers.



When a window of an automobile breaks, some pieces of the glass fall into the window aperture.. A simple and serviceable tool for removing the glass from a car body is illustrated above. It consists of a lath, to which spring steel wire is attached with staples. The wire is pushed over the glass and will hold it tightly, permitting the fragment to be removed.

In the instance of a door, it is possible to remove the hinge pins and remove the glass by inverting the door.

The removal of glass from the car body, however, requires a tool of some form for this use.

An example of a simple and serviceable tool, devised by one owner recently for this purpose, is shown in the attached sketch.

This consists of two pieces of steel spring wire bent to form grips. The wire is attached to a lath with staples. The opening is made so that it will spring over the glass and give enough grip to lift the broken glass parts out of the body.

An ordinary flash light aids the user in locating the broken parts and attaching the tool. Material for this tool is usually available around the garage.

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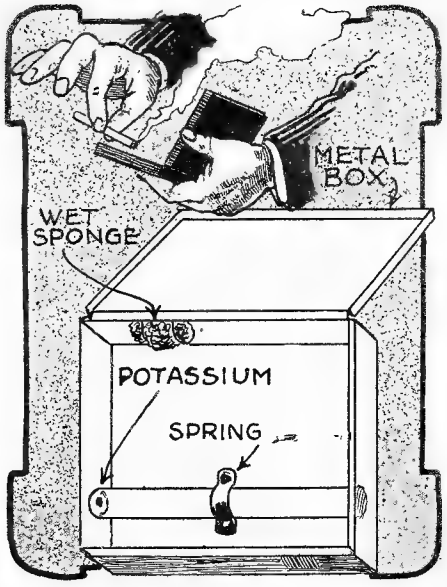
MAGIC

By "DUNNINGER"

NO. 67 OF A SERIES

THE BEWITCHED CIGARETTE



The cigarette can be made to light itself and can actually be removed from the cigarette box lit, if the method here illustrated is employed. A wet sponge and a piece of potassium serve to light it.

In concluding any sort of a cigarette vanishing or producing act, which can be composed of those many different styles of vanishes and productions, previously explained in this publication, a lit cigarette can be vanished, and two or three minutes later it can again be produced, still lit, from the interior of a cigarette case. This cigarette case will also be useful as a small pocket trick for the after-dinner trickster. The method in which the effect is carried out is very simple. One or more cigarettes are clipped to the interior of a metal box by a spring clip. In the tips of each of these cigarettes there is a small piece of metallic potassium. As the magician opens the lid of the box, it is not at all difficult to twist the cigarette to make it contact with the wet sponge placed within the box, which in turn causes the potassium to ignite and lights the cigarette. Care should be exercised in handling the potassium.

NEW KERCHIEF CYLINDER

This is a clever deception rather simple to execute and quite effective. The conjurer first exhibits a plain glass cylinder, which appears to be quite clear and unquestionably empty. With a sharp movement into space, a large silk handkerchief is mystically caught in thin air and it finds its way into the cylinder, completely filling it. Both silk and tube are immediately passed for examination. By way of explanation, the silk was rolled into a small compact and concealed beneath the lapel of the performer's coat. A fine silk thread was attached to a corner of this handkerchief, passed through the tube, and then tied to a coat or vest button. With a quick movement of the cylinder in an upward direction, the silk is brought from behind the coat lapel, flashes in the air and then finds its way into the cylinder. The thread is now quickly broken, and the entire is passed to the audience for examination.

A glass cylinder quite clear and empty will be found to suddenly contain a handkerchief apparently caught out of thin air. A piece of thread passing through the cylinder and the kerchief beneath the coat lapel permit of this effect.

HYPNOTIZED STRAW

Next time you go to a soda fountain you can demonstrate to your friends your ability to hypnotize a soda straw and cause it to rise up in the palm of your hand provided that you have previously attached the gimmick illustrated.

Apparently the only apparatus used in this trick is a soda straw such as is ordinarily found at soda fountains. This is placed flat upon the palm of the magician's hand, and after a few hypnotic passes are made over it with the other hand, the straw is seen to mysteriously and slowly float or move upward, until it stands in an upright position. It can be left in this position or again permitted to gradually sink to the palm. At any moment it may be passed for examination. The secret is exceedingly simple. A small plug made of light wood is just large enough to hold the end of the straw. The point of a needle is driven into this plug. Before demonstrating the trick, the needle point is made to pass into the skin of the palm of the hand. By stretching the palm, the plug rises; relaxing causes it to fall. A soda straw being much lighter, this stunt is a vast improvement over the old pencil trick, in which the weight of the pencil made the operation of the trick practically impossible.

The Elusive Bottle

Snappy effects are quite the vogue with the up-to-date conjurer. In this particular stunt, an assistant brings forth a bottle of Volstead's departed spirits. The conjurer places a kerchief over the top of the bottle; then, apparently lifting the bottle, he causes it to vanish in air. The stunt is performed in the following fashion. The bottle itself is merely a sheet of celluloid painted to imitate a bottle and curled to further increase this illusion. Its shape is maintained by a hook at the back edges. The bottle is hinged to a tray. The handkerchief is prepared with a disk the same size as the mouth of the bottle. When placing the handkerchief over the bottle, the hook is released, the bottle falling flat to the tray, then the bottle is apparently lifted by holding the disk in the handkerchief. Grasping the corner and snapping it completes the vanish.

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Can You Answer These Questions?

(Form your own answer before turning to page indicated)

1. What is the proper way in which to light a gas range, particularly the oven burner? (See page 493.)
2. How is thermit used to break up large ice jams in rivers and harbors, as well as icebergs? (See page 494.)
3. How was compressed air used to raise a sunken German warship off Scapa Flow? (See page 496.)
4. Explain in a few words the action taking place when a geyser spouts. (See page 498.)
5. How does the televox—the electro-mechanical man—speak? (See page 499.)
6. Can you name five points of similarity between the human body and the automobile engine? (See page 500.)
7. Name two serious diseases that a dog may transmit to man, if proper precautions are not observed. (See page 502.)
8. Given a selenium cell, a source of light, an amplifier and a loud speaker, could you devise a system whereby the blind can read an ordinary book? (See page 505.)
9. What is the relation between the probable end of our sun and the electronic structure of the iron atom, according to the English scientist, Dr. J. H. Jeans? (See page 506.)
10. Do you know the difference and the relative merits of the straight and the diagonal splice for movie films? (See page 513.)
11. Can you explain how the new Kodacolor movies work, without the use of any tints or dyes applied to the film? (See page 514.)
12. Do you know how to make aluminum wool? What happens when potassium chlorate tablets are heated in a test tube? (See pages 518 and 519.)

AIRPORT OF NEW YORK CITY

By WILLIAM P. SULLIVAN

(Chief Aeronautical Engineer to Clarence Chamberlin)

THE City of New York has begun work on its new airport, which if present plans are carried out, will equal, if not surpass, the airports now in operation in this country and in Europe.

The site selected for the airport is ideal, located on Barren Island, now connected to the mainland at the foot of Flatbush Avenue, in the Borough of Brooklyn. This places the airport within the city limits of Greater New York, a factor first to be considered in the selection of any municipal airport contemplating future commercial airline terminals. Another salient feature, and one that is generally neglected in the majority of airports, is the seaplane landing with facilities near the landing field proper. Incorporated with these advantages is the natural condition of the surroundings, which present no obstructions of any kind, allowing for the best possible design of the field runways and arrangement of buildings, such as administration offices and hangars.

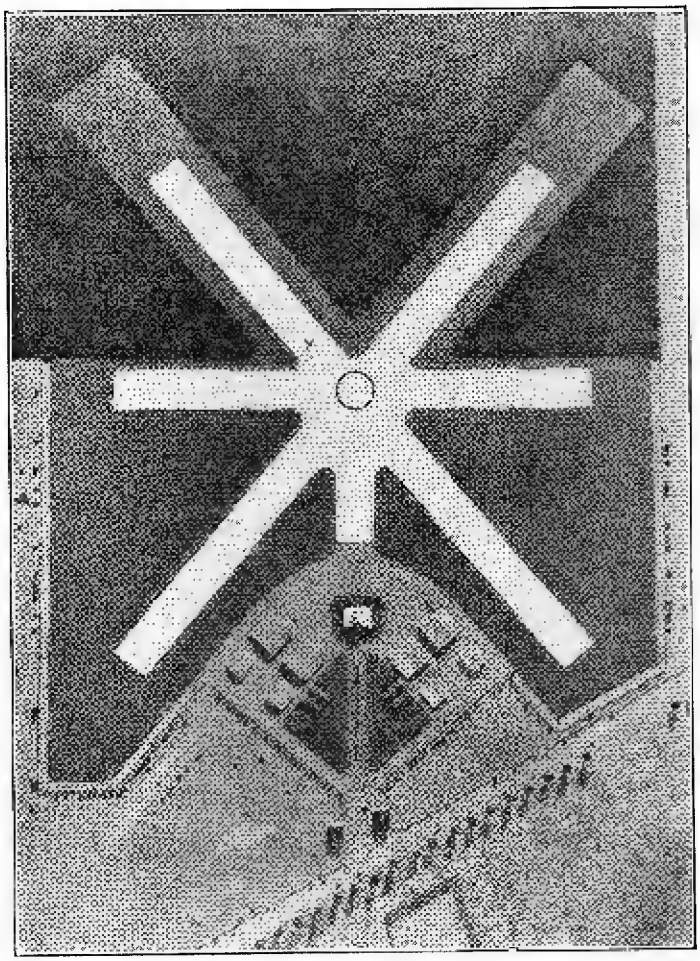
The flying field area consists of approximately 350 acres. The surface is at present coarse beach sand and is being filled and graded to the desired level. Upon this sand area the complete flying field is to be constructed.

The general layout of the field has not been fully decided upon, although several models have been made showing the various arrangements of the field buildings and runways. In this way a final arrangement will be drawn and construction of the field, runways and buildings will begin.

The field plan contains three paved strips, two being 150 feet wide by 3,300 feet long, and one 150 feet wide by 2,200 feet long, laid out with reference to the general direction of the prevailing winds, crossing each other at the center of the entire area and leading from the center to the administration buildings and hangars. These are to be used as all year round stretches of smooth surface, both for landing and taking off.

CONSTRUCTION OF RUNWAYS

THESE runways are constructed of several layers of material, as follows: Four inches of coarse cinders, or clinkers, mixed with road oil and rolled to a hard surface. On top of this five inches of medium cinders mixed with an asphalt binder is rolled down to a hard surface. The finished surface, consisting of one-half an inch of crushed stone and asphalt, is then rolled to a flat finish. This finish prevents the breaking up of the surface by tail skids and imperfect landings, and assists drainage. At the intersection of these strips a circle 100 feet in diameter by four feet wide, paved with a similar material and painted white, forms the field marker.



Model of New York City's new airport to be built on Barren Island. Seaplanes and land planes can use it. The field will be suitably illuminated at night.

Additional runways extend for 175 feet on each side of the paved strips, and 400 feet from the ends. These are surfaced flush with the paved sections with clear, smooth surface on the two main sections 500 feet wide by 4,000 feet long, with clear approaches. The sections near the hangars will also be covered with grass, thereby enabling the airplanes to use these sections for ordinary take-offs and landings also diminishing the distance required to taxi to the paved strips, and vice versa.

This grass surface covering is now being experimented with under varied top soil conditions, to determine the best combination and thickness of soil necessary to grow and maintain a thick grass surface. From these experiments the best results have been determined by the use of a clay base, rolled to a thickness of six inches and a topsoil of four inches seeded with heavy grass seed, and rolled. .These runways and paved strips form a level area on which airplanes of all sizes can readily take off and land in any direction.

The hangars will be of modern construction of large size; capable of housing the largest type of plane with ease, and will be equipped with offices and shops. Additional shops will be located near the hangars for general repair work.

The administration building will be located near the center of

(*Continued on page* 570)

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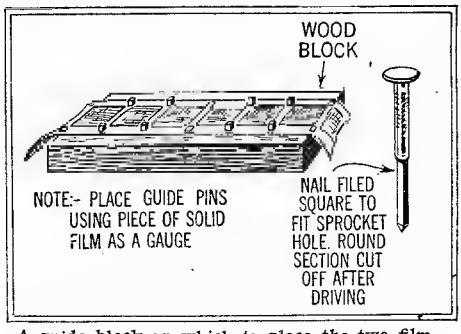
Home Movies

CONDUCTED BY DON BENNETT

Splicing and Editing the Home Films

No. 3 of a Series

AS Jones and Blake approached the cutting desk, Jones picked up a notebook from the counter and carried it with him. When they were seated he placed the first reel on the re-

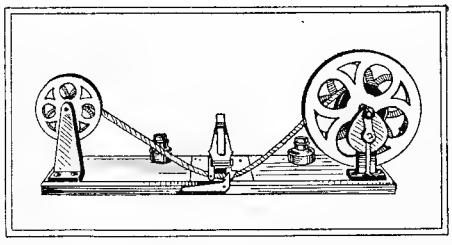

WOOD BLOCK
NOTE:- PLACE GUIDE PINS USING PIECE OF SOLID FILM AS A GAUGE
NAIL FILED SQUARE TO FIT SPROCKET HOLE. ROUND SECTION CUT OFF AFTER DRIVING

A guide block on which to place the two film ends to be spliced, is shown above.

winders and placing an empty spool on the winding side, he cranked the film all the way over until the beginning of the reel was again on the outside. Then he reversed the reels and slowly wound them along, looking through the film as he did so. A small light was placed behind a piece of ground glass and furnished the illumination and enabled him to see clearly the images on the film. He removed the bad first scene entirely and spliced the leader film in at the group. This shot was very well made and furnished a good opening scene for this home movie album. Jones made a few notes in his book while the cement was drying and had started on to the next scene when Blake interrupted. "Would you mind explaining that splicing operation to me. It seems terribly complicated.

"Why, it's very simple, Mr. Blake. There is a little instruction book that comes with each splicer and it explains very thoroughly the operation of the splicer itself. You see there are two ways of splicing film, one straight across with the two sprocket holes of each piece of the film superimposed, and the other, in which the film is cut diagonally and each sprocket hole has only one layer of film around it. I personally prefer the diagonal splice as it is much stronger. Instead of only five-eighths of an inch of holding surface as in the straight splice, the diagonal has over eleven-sixteenths inch. In addition to this there is the added resiliency in a diagonal splice, and as every splice is a weak point in a film, this is important. When you are splicing, it is well to have a small bottle of water handy and a brush to apply it with. You moisten the end of one film, on the emulsion side of course, and after the water has soaked in for a few seconds, you scrape it with a razor blade or some other straight sharp scraper. Some prefer scraping the film without wetting it but I believe that when you dry all the water off before applying the cement the splice will last as long as when it is scraped dry.

"The other piece of film is cut but it is not necessary to scrape it as the side that will be joined to the other film has no emulsion on it. Sometimes with old or oily film it is advisable to scrape the clear side of the film but this is necessary only in extreme cases. When the two ends are ready and have been placed over the guide pins, the most important part of the splice is at hand. There is danger in applying too little cement, as the splice may part in the projector at a very important part of the film. It is almost as bad to apply too much



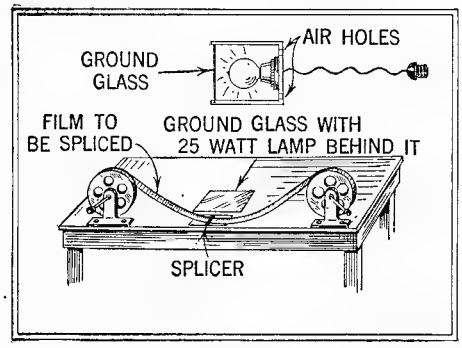
Above we see a manufactured style of 16 mm. film splicer and winding reel outfit.

cement, as then the splice is smeared with the excess and becomes stiff and brittle, possibly causing a break.

"Even though your films are in correct chronological order, they should be rearranged to make them more interesting. For example, this group scene you took of the family can be improved by cutting in close ups of the individuals."

"But where can I get the close-ups?" queried Blake.

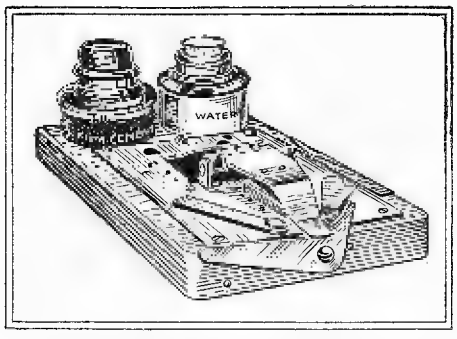
"We will cut them out of that fast panoramic shot that is blurred. A few of the individuals will show up clearly and without blurring and we can cut them into this long shot of the group. The only other thing to do with the film is to insert titles introducing each person. Let's choose a main title for your whole film. Let's see, now. How about "History of the Blakes, recorded a la movie." Then a credit title, "Photographed by Harry Blake," a date title, "Started anno Domini 1928." Then on your next roll of film shoot a few feet of the house and cut it in at the start of the film with a title "Ancestral mansion of the Blake family, Rockland." Before this group scene insert a title, "The Blakes pose for their first movies," and the date that the scene was taken. Cut the scene near the center and insert one of the close-ups with a title telling whom it represents. Then



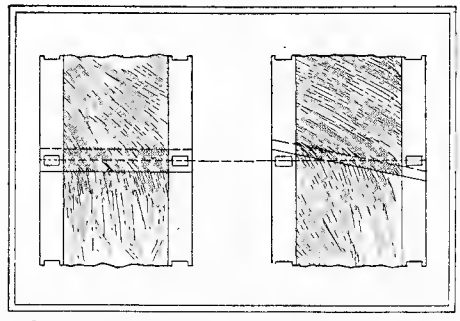
An electric bulb placed behind a ground glass screen proves useful in examining the film.

another title and close-up of another of the group. When you have inserted all the close-ups, cut back to the group scene again. Then go on with the next sequence, titling it according to the scenes you have made. One thing to remember in your titles is to keep them as short as possible but do not sacrifice words to the elimination of clarity. Your title should explicitly explain your thought yet be condensed in as few words as possible. Just imagine you are writing a telegram at ten cents a word, your titles will then be about the right length. Try not to have two titles together except at the start of the film, in which case it is permissible. On the other hand, if you find it necessary to use more than twenty-five words in your title, break it up and use two titles of nearly equal length. Two titles may be run together in a travel film, where you have visited a great many places and have made many scenes in each one. For instance, if you take a trip to Washington, you could have a title, "Washington, D. C." followed by another title, "The Capitol." Then a scene of the Capitol building from as many angles as you cared to show. Each place visited in the city would carry a descriptive title of the scene. Assume that on the way back you stopped

(*Continued on page* 573)



A manufactured type of 16 mm., film splicer and cutter is illustrated herewith.



The straight film splice is shown at left; the stronger diagonal splice appears at the right.

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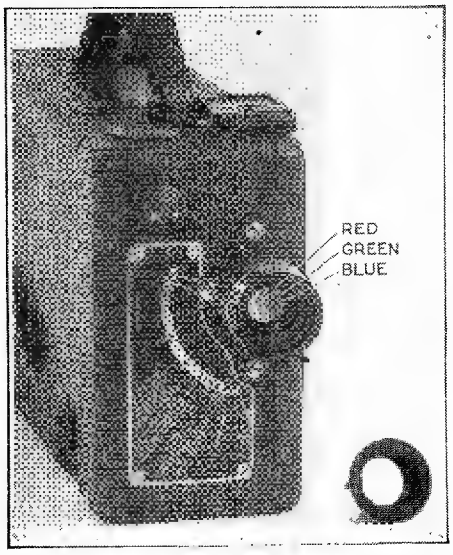
Color Movies For The Amateur

Home Movies in Natural Color Are at Last Available for 16mm., Cine-Kodak and Projector Equipment



Those home movie fans owning a Cine-Kodak with an F1.9 lens need only buy a color filter, shown above, in order to take colored motion pictures.

THE way in which the new Eastman process makes colored motion pictures is not so occult as such a remarkable development might seem, yet it works by such microscopic neo-magic as only the methods of medern science can deal with. A phenomenon of the process is that the film itself contains no color at any time.

HOW COLOR FILM IS DIFFERENT

THE amateur cinematographer's part has been made easy. He merely has to insert a *color filter* into his camera and thread his kodacolor film. But actually, when he makes color movies, without knowing it he uses hundreds of lenses and he disentangles thousands of tenuous threads of light.

The many new lenses introduced in the process are cylindrical lenses embossed right on the film, composed of the film base material and extending lengthwise of the film. The lenses on the film are about seven times narrower (1/559 of an inch) than the tiny dots making up the illustrations in a newspaper (65 to the inch) and as such they are invisible except under a microscope. They cover completely the surface of the side of the film opposite from the sensitive emulsion. That surface faces the camera lens as the pictures herewith show, and the emulsion is away from the lens, contrary to the threading arrangement for ordinary film.

When the trigger of the camera is pressed, light reflected from the subject passes selectively through the three-color filter, on through the camera lens, and thence through the tiny embossed lenses on the film to the sensitive emulsion coating on the opposite side, where it records itself upon the silver compounds therein contained.

White light, as is well known, is composed of all the colors of the spectrum. This can be seen when white light shines through a prism or when it appears as a rainbow reflected prismatically from the drops of falling rain.

The color filter is striped in the three primary colors of the spectrum—red, green, and blue. The reverse of the fact that white light divides up into the colors of the spectrum is that light coming evenly out from the three colors of the filter on a projector and superimposed on a screen appears white.

But cover up the green and blue segments of the filter and the screen will turn red. Cover up the red and blue and the result will be green. Similarly, white light minus red and green gives blue.

White light minus blue only, with the red and green areas both left for the light to shine through, gives yellow. White minus red gives blue-green. White minus green gives purple. Varying the areas of each color through which the light may shine gives the infinite shadings between these colors. Black is the total elimination of light.

HOW COLOR FILTER WORKS

OUT of the rays of light which spread like a fan over the filter from every point of color in front of the camera, the red area lets only the red fraction go through to the lens, the green lets only the green through, and similarly the blue excludes all but the blue. Kodacolor film is *panchromatic,* that is, it is equally sensitive to all colors. Through the camera lens these separated rays pass, each to be focused on the part of the film frame corresponding to the part of the subject from which it came.

Then the embossed lenses do their work. If there were no embossed lenses, the rays representing the three colors would converge on the sensitive emulsion as a single point and the film would become ordinary black and white, with no differentiation of colors on the film. But the embossed lenses guide the one or two or three rays falling upon each tiny area of the film and lay them on the sensitive emulsion in an orderly fashion, as three distinct impressions at any one spot. See diagram for this detail.

Just as the camera lens spreads an image on the scene in front of the camera over the whole film surface, so each of the minute embossed lenses portrays, on the very small area of sensitive substance that it covers, the scene immediately in front of it—which is the camera lens as seen from that particular point on the film. Of course this means that the sensitive emulsion behind each tiny embossed lens will receive, not an image of the whole scene in front of the camera, *but only a small bit of the scene, since any point on the film receives rays from only a corresponding space on the scene in front of the camera.*

The three filter colors covering the lens are imaged behind each tiny cylindrical lens as three parallel vertical strips, because the tiny cylindrical lenses are parallel to the strips of color on the filter. Thus the width of each of the minute areas of emulsion is subdivided into three parts related to the three filter colors and affected by light that is able to pass through the colors. The sum of these invisibly small affected areas of film constitutes the whole photographic image.

A red ray from an object in front of the camera, for instance, touches the sensitive material of the film at a spot related to the red area of the filter. Developing by the *reversal process* in use for amateur movie films turns this affected spot into a transparent area, leaving opaque the adjoining unaffected areas related to the green and blue segments of the filter. Therefore, in this case, the projector light can shine only through the invisible small points on the film which will send beams to the red projector filter, and out to the screen as pencils of red light.

So also with the green and blue and with combinations of colors. The sum of the points on the scene containing red makes a photograph from red light on the emulsion areas related to the red filter segment, the sum of the blue also makes a separate photograph, and similarly with the green.

HOME movies in colors is at last a practical everyday accomplishment, thanks to indefatigable research of the Eastman photograph experts. If one happens to own a Cine-Kodak fitted with an F. 1.9 lens, all that is necessary is to purchase at nominal cost, a color filter to fit over the camera lens. The camera is then loaded with the specially prepared film, which costs about twice as much as the standard black and white film. After exposure, the film is mailed for development, and when received back again the pictures appear in black and white. In order to project the pictures in colors, another color filter is slipped over the lens on the projector. If the color filter is left off the projector, the pictures appear in the ordinary black and white on the screen.

In order to project the new color movies developed by the Eastman experts, one has but to fit a color screen over the lens of the projector.

PROJECTION

RECOLLECT now the explanation of how various colors are thrown onto the screen by covering up different combinations of filter colors on the projector. Well, that

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is just how kodacolor is projected. The opaque areas of the film cover up, in effect, certain of the filter colors: they prevent the light from going through where it is not needed, by cutting off, at the film, rays which would otherwise pass out through the embossed lenses, through the camera lens, and through the filter color in question to the screen.

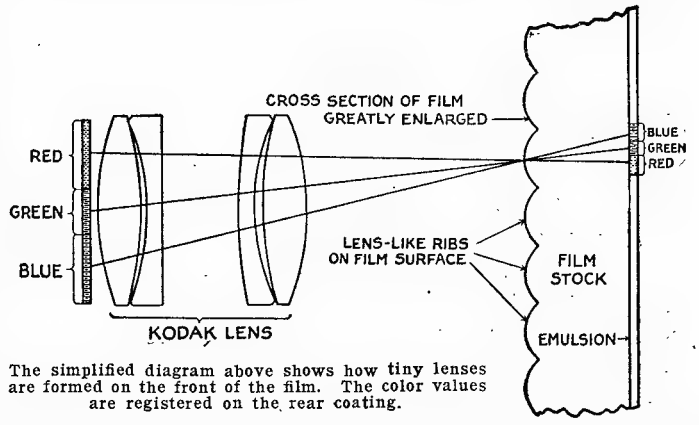
For any point on the scene, only the colors are permitted to be projected which blend on the screen into the corresponding original colors of the scene photographed. The pattern of these rays from all the cylindrical lenses on each frame projects a picture on the screen, with each ray contributing its speck of light to the color or blend of colors at one point.

The film itself is not colored. The colors of the subject are delineated merely by transparency on the film or by black metallic silver deposited in various degrees of opaqueness, so as to permit light to shine through one of the three sections of the filter as directed by the tiny film lenses.

Despite all this difficult description, the most important fact about the new process is that henceforth amateur photographers can make movies in full natural color without giving a thought to the minute magic of the process.

REMARKS BY DEPARTMENT EDITOR

AFTER many, many years of experiment, the foundations of which were laid before many of us were born, color movies, long sought for, are placed within reach of the amateur movie maker. The kodacolor process, recently announced, is in itself a culmination of only a few years of experimenting, but still photography has been limited to black and white until the last decade. Of course, professional producers have had available for some few years color processes that were practical but expensive. These professional pictures, figuring on the basis of the color photography alone, without allowance for salaries or production expense, cost in the neighborhood of $1,500 a reel of a thousand feet for the negative. The new amateur process works from the same basis as the present methods, but with refinements and a wider range of true color reproduction. Those familiar with printing will recall that natural color printing is done by separating the original into three or four colors. If three, red, yellow and blue are used; when four colors are used black is added. The professional color pictures use two colors, red and green, utilizing two negatives for taking and coating both sides of the film for projection. Because of the limitation of two color reproduction, true natural colors are not obtained by these processes, although it must be admitted that they are so close, that only those acquainted with color or photography are able to perceive the difference.

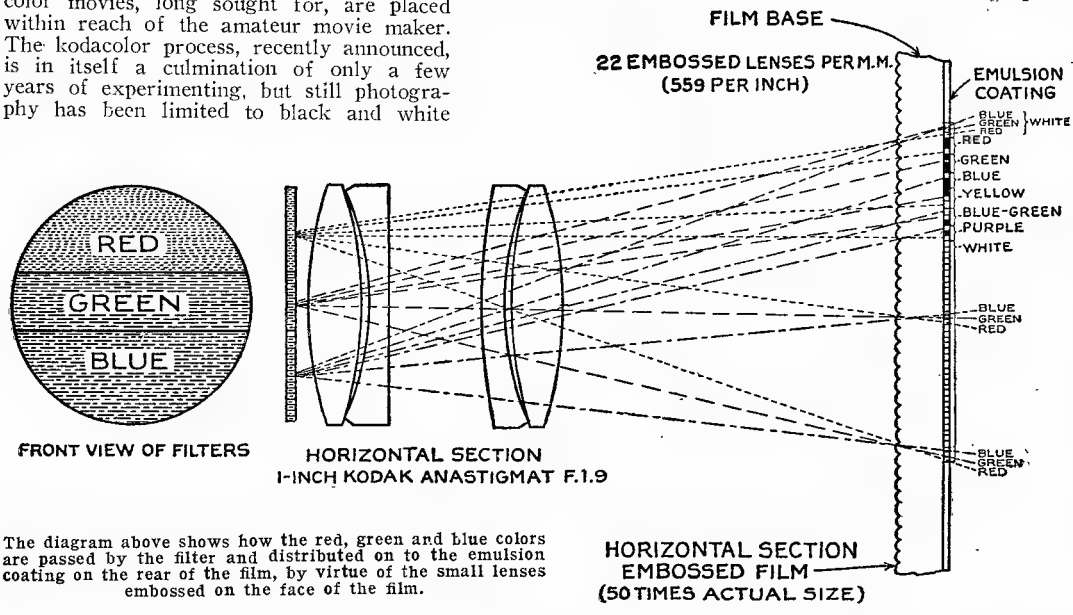


The simplified diagram above shows how tiny lenses are formed on the front of the film. The color values are registered on the rear coating.

With the kodacolor process, the base of the film is embossed with miniature bumps that have the effect of lenses. These are spaced 559 to the inch. A special color filter is slipped over the lens and the lens is opened to f 1:9.

The light coming through the filter is separated into red, blue and green. It is in turn re-photographed on the film through the miniature lenses mentioned before. The film is processed and the positive is black and white and may be so projected, but by slipping a projection screen over the lens pictures in natural colors are shown on the special aluminum screen. Due to the great density of the filter a special high powered illuminating system is required and the size of the picture is limited to 16½ by 22 inches. This, however, is of sufficient size so that all characters fairly close to the camera may be recognized and the close-ups are quite perfect reproductions of the original subject.

It is said that the present cameras and projectors can be equipped to handle kodacolor at a relatively low cost, but some camera owners, fortunate enough to be equipped with an f 1:9 lens, will need no additional equipment, except the special filter that is comparatively cheap. The cost of the film is twice that of the present 16mm film. At present the film is available only for 16mm cameras, and as color duplicates cannot be made, it is not expected that the process will be adopted by professional producers. It is apparently an amateur proposition.



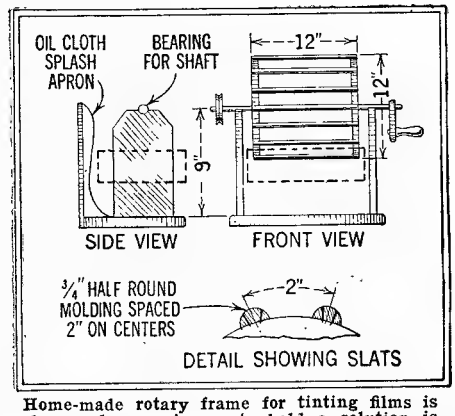
The diagram above shows how the red, green and blue colors are passed by the filter and distributed on to the emulsion coating on the rear of the film, by virtue of the small lenses embossed on the face of the film.

Tinting Apparatus for the Amateur

THE amateur movie enthusiast who enjoys tinkering with his films will probably be interested to learn that a simple apparatus for tinting and toning his films can be cheaply made. This apparatus is a small edition of the equipment originally used in motion picture laboratory work and has been selected because of the economy of solutions needed and the simplicity of operation. It is more certain of results than the professional equipment where the amateur is concerned, and was discarded by professional laboratories only because of its bulk.

The drum illustrated herewith will hold approximately fifty feet of sixteen millimeter film at a time. Less than two quarts of chemical solution is required as compared to the forty gallons needed for a professional tank. The drum is made up of two circular end pieces, one inch thick, to which are nailed the horizontal slats which are made of three-quarter inch, half-round molding. A one inch wooden shaft is run through the drum and is supported by an upright at each end. The center of the shaft should be nine inches above the top of the baseboard. An 11 x 15 inch enameled tray is placed under the drum for the dye solution.

The drum should be painted with acid-proof paint or hot paraffin. A motor may be attached to the device but be careful that it is not run at too great a speed, or chemicals will be splashed out into the room. The same drum can be used for washing and drying the film after it has been colored, and also for developing your own titles. When drying be sure that the drum revolves at a good rate of speed until the film is completely dried or "drying marks" will result.—*Contributed by Don Bennett.*



Home-made rotary frame for tinting films is shown above. A pan to hold a solution is shown in dotted line. Details are given at left.

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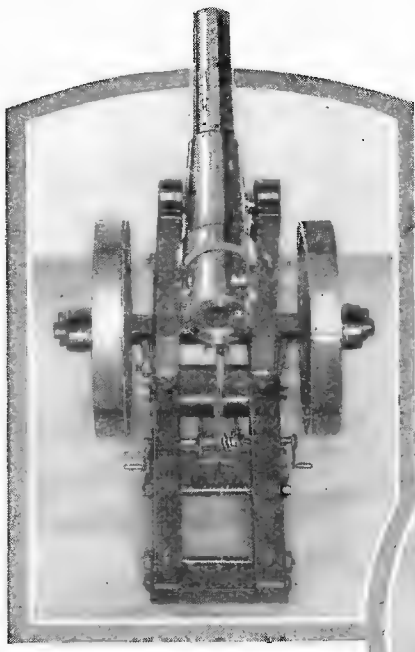
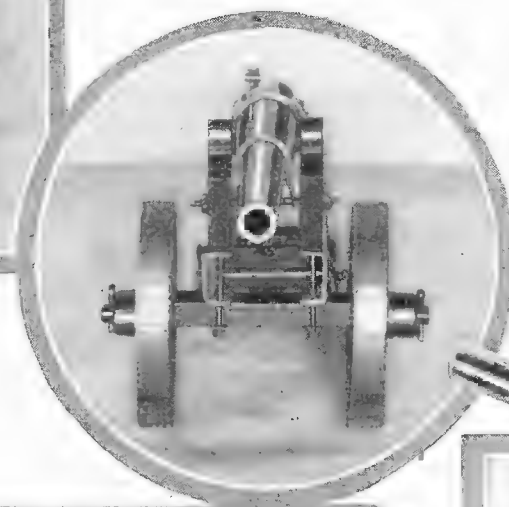
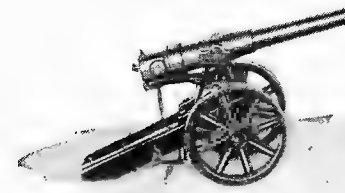
Model Department

Siege Gun Model Wins this Month's Trophy Cup

Ringkannone of About 1870 Made by M. L. Hughett of Perry, Oklahoma



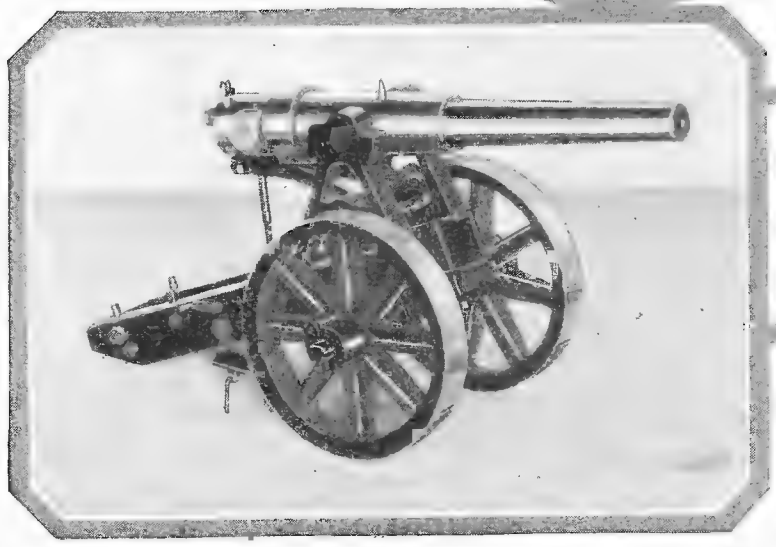


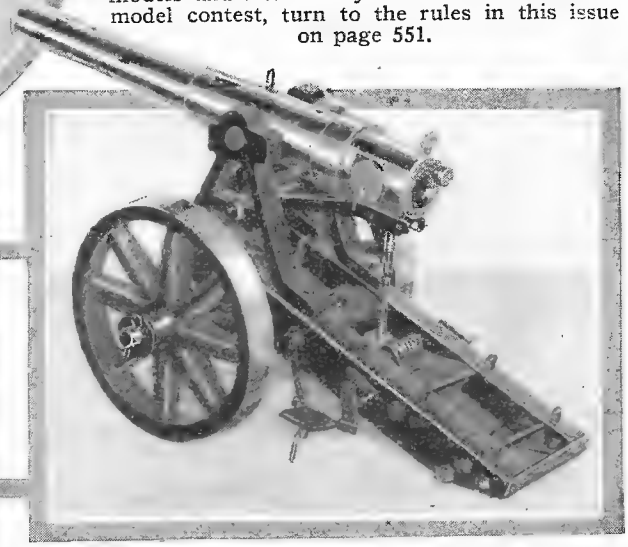


At the right you see a photograph of the cannon and trophy cup which was awarded to it. ⟿

This is a model of a cannon which was originally of German manufacture and was first used as a siege gun in the year 1870. A few of them were captured and brought to this country after the World War. The breech block, it will be noted, slides into place from the side and it is there locked into position by a square key. The front sight of this cannon is stationary, but the rear sight may be raised or lowered by manipulating the set screw in the back. While the barrel of this gun is made of brass, in the actual full size gun it is made of steel. In order to produce a realistic finish it is, therefore, quite necessary that the brass be painted so as to resemble the steel of the original barrel. Practically all the bolts used in the construction were made of nails, the heads of which were filed to a hexagon shape. If you have built any models and have not yet entered them in the model contest, turn to the rules in this issue on page 551.

The photographs surrounding this space show the different views of the cannon which won the prize winning trophy in this month's model contest. One of these awards is made monthly and the best model submitted during the month wins it.





This neat and trim little model can be constructed quite easily by following all the instructions given on the blueprint on the accompanying page. In this model the gear used to elevate the gun was obtained from a mandolin. In the actual construction bevel gears are employed in the place of the rig here indicated.

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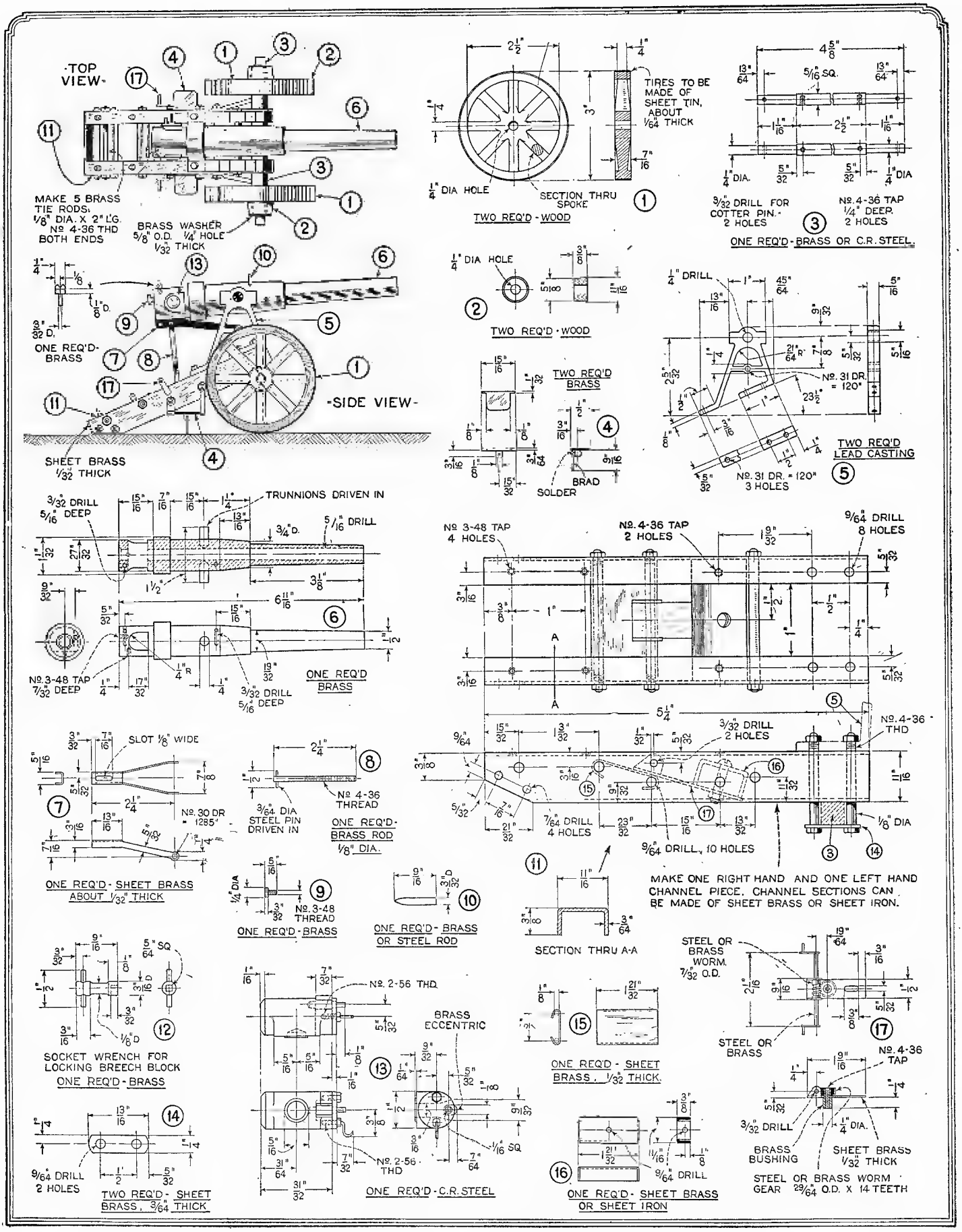
MODEL CANNON DETAILS


-TOP VIEW-
MAKE 5 BRASS TIE RODS, 1/8" DIA. X 2" LG. Nº 4-36 THD BOTH ENDS
BRASS WASHER 5/8" O.D. 1/4" HOLE 1/32" THICK
-SIDE VIEW-
SHEET BRASS 1/32" THICK
TIRES TO BE MADE OF SHEET TIN, ABOUT 1/64" THICK
1/4" DIA HOLE
SECTION THRU SPOKE
TWO REQ'D - WOOD
3/32 DRILL FOR COTTER PIN. 2 HOLES
Nº. 4-36 TAP 1/4" DEEP. 2 HOLES
ONE REQ'D - BRASS OR C.R. STEEL.
TWO REQ'D - WOOD
ONE REQ'D - BRASS
TWO REQ'D BRASS
BRAD
SOLDER
1/4" DRILL
Nº. 31 DR. = 120°
3 HOLES
TWO REQ'D LEAD CASTING
TRUNNIONS DRIVEN IN
3/32 DRILL 5/16" DEEP
5/16 DRILL
3/4" D.
Nº. 3-48 TAP 7/32" DEEP
ONE REQ'D BRASS
Nº. 3-48 TAP 4 HOLES
Nº. 4-36 TAP 2 HOLES
9/64 DRILL 8 HOLES
3/32 DRILL 2 HOLES
Nº. 4-36 THD
7/64 DRILL 4 HOLES
9/64 DRILL, 10 HOLES
1/8" DIA
SLOT 1/8" WIDE
Nº. 30 DR = 1285"
ONE REQ'D - SHEET BRASS ABOUT 1/32" THICK
3/64 DIA STEEL PIN DRIVEN IN
Nº. 4-36 THREAD
ONE REQ'D - BRASS ROD 1/8" DIA.
Nº. 3-48 THREAD
ONE REQ'D - BRASS
ONE REQ'D - BRASS OR STEEL ROD
SECTION THRU A-A
MAKE ONE RIGHT HAND AND ONE LEFT HAND CHANNEL PIECE. CHANNEL SECTIONS CAN BE MADE OF SHEET BRASS OR SHEET IRON.
STEEL OR BRASS WORM. 7/32" O.D.
STEEL OR BRASS
SOCKET WRENCH FOR LOCKING BREECH BLOCK
ONE REQ'D - BRASS
Nº. 2-56 THD.
BRASS ECCENTRIC
Nº. 2-56 THD
ONE REQ'D - C.R. STEEL
ONE REQ'D - SHEET BRASS, 1/32" THICK.
9/64 DRILL 2 HOLES
TWO REQ'D - SHEET BRASS, 3/64" THICK
Nº. 4-36 TAP
3/32" DRILL
1/4" DIA.
BRASS BUSHING
SHEET BRASS 1/32" THICK
STEEL OR BRASS WORM GEAR 29/64" O.D. X 14 TEETH
ONE REQ'D - SHEET BRASS OR SHEET IRON

The above diagram gives the full details for the construction of the cannon which won the cup in the Model Contest for this month. Practically the entire cannon, with the exception of the wheels, was built of brass, although some of the parts thereof could easily have steel substituted for the brass.

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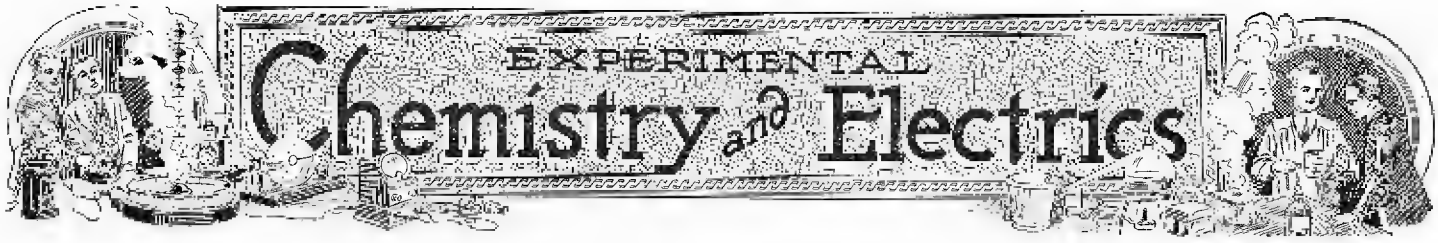


Aluminum Wool-A Remarkable Experiment

By O. IVAN LEE, B.Sc., F.M.S.A.

APPARATUS AND CHEMICALS NEEDED

THE materials necessary for this weird experiment are as follows:

A flat sheet of rolled aluminum plate about 1/32 of an inch or less in thickness and three or four inches square. That commonly in use for making pie plates is very suitable.

The top of a small baking powder can or similar small shallow iron vessel.

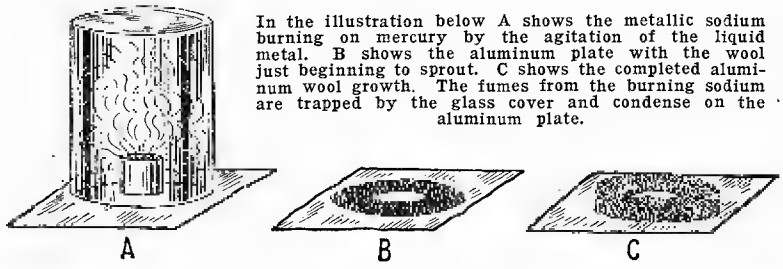
A drinking glass or glass beaker small enough when inverted not to extend over the edge of the aluminum plate but sufficiently large to leave a margin of an inch or so when covering the baking powder can top.

An ounce or so of metallic mercury.

A small fragment of metallic sodium.

DIRECTIONS FOR THE EXPERIMENT

THE small metal container is placed in the center of the aluminum plate and sufficient mercury poured in to cover the bottom to the depth of a quarter of an inch or so. A piece of clean, freshly-cut metallic sodium about one-half inch in diameter is then dropped on the mercury where it will float much higher than a cork on water. Several burning matches are then dropped in succession alongside the sodium, and eventually the lump will be seen to lose its shape and slump down in a more or less molten condition. The glass vessel is now inverted over the iron one, and the aluminum plate rocked sufficiently to agitate the mercury floating the molten sodium. This will result in a number of bright flashes, accompanied by dense clouds of smoke of a buff or yellowish color, and which will condense on the cold surface of the glass as well as on the exposed portion of the aluminum, as a yellowish stain or discoloration. After a few minutes, when most of the smoke has had an opportunity to condense and a pronounced stain is visible, the aluminum plate is removed and placed conveniently for close observation and inspection.



In the illustration below A shows the metallic sodium burning on mercury by the agitation of the liquid metal. B shows the aluminum plate with the wool just beginning to sprout. C shows the completed aluminum wool growth. The fumes from the burning sodium are trapped by the glass cover and condense on the aluminum plate.

In a short time it will be noticed that the stain, which was originally a mere tarnish, appears more pronounced; in fact, it soon appears to have an appreciable *thickness*. A few minutes more and an appearance resembling the down on a peach will be seen, and as one watches, it becomes very evident that *the aluminum is actually sprouting a beard, and a white one at that!* Before one's eyes the "beard" rapidly assumes the dignity of "whiskers" and the growth becomes so rapid that *the wool can actually be seen to grow.* A miniature forest of feathery ferns appears, which curve and twist and interlace and not infrequently break of their own weight, and in half an hour or so, some of the feathers or fronds will be found to measure half to three-quarters of an inch in length! They are gray-white in color and exceedingly light, so that if it is wished to preserve the wool for exhibition it should be covered with a glass.

PROBABLE MECHANISM OF THE REACTION

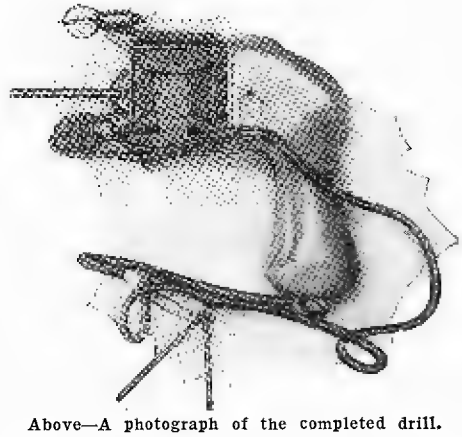
CHEMICALLY, the "wool" is probably an aluminum oxide or hydrate, which sprouts through the agency of sodium oxide and peroxide, possibly aided by an electric action between the aluminum and mercury vapors condensed on its surface with the alkali. It is illustrative, too, of the fact that rolled aluminum is not homogeneous in composition, but has a very highly laminated structure like mica, consisting of an almost infinite number of sheets of metal separated by films of aluminum oxide. Hence, when the layers of oxide are attacked chemically, the layers of metal are released from their state of strain and tend to curl and twist, as they are attacked by the chemical.

Electric Hand Drill

The very interesting electric drill operating with 6 volts potential and made out of odds and ends, is described here.

First, get a motor horn—take the motor out; cut the front metallic support, so that the bearing can be used; next, get an auto light connection and solder to front metal of motor—use telephone-receiver cords to carry current from the battery to the motor—I have placed a small 6-volt light on front of motor, to be used in dark places or when working at night. This light can be disconnected if necessary, by shifting the connection out of the socket or under side of the motor, and then pulling light bulb forward to slip out of brass socket at the top of the motor.

I used a piece of pine timber 1½ x 4 and about 5 inches long, from which to cut a pistol grip stock, attached motor to stock, as you see, by brass strip above and below, by cutting out a slot for rear motor-bearing and frame to slip back into. See oil hole for rear bearing, also clip to hold cord out of way of work. The trigger for contact for current is constructed of brass strips and platinum points, from old discarded Ford coils. A hole is bored in the handle with



Above—A photograph of the completed drill.

screw clutch for drills. This little drill when attached to a fully charged 6-volt battery, will drill up to ⅜-inch in wood with great speed. Also will cut bakelite and such material with small drills and is handy about radio work and similar jobs. Can be used for setting up screws by having a screwdriver attached in place of drill. I believe your readers will be interested in this idea and will use larger than 6-volt motors for greater service.—*E. T. Sonendriker.*

INSULATING RODS

Fairly good ebonite or bakelite rods can be easily made from old phonograph records.

A record is broken into small pieces and placed in an iron ladle, denatured alcohol being poured over them. The ladle is supported on a tripod and the alcohol ignited. An alcohol lamp or other source of heat is also applied to the bottom of the ladle. This is removed if the alcohol boils too vigorously. The pieces soon melt into a softened mass. While it is in this condition, it is quickly scraped out and rolled between two smooth boards, pressing firmly meanwhile. Speed counts at this point as it soon becomes hard and rather brittle. If all has gone well, a fairly smooth rod results. The ends are rounded off by a heated, rounded object such as an old spoon. The rod may be finished up with emery paper.

These rods are useful for many purposes and serve well for static electric experiments. It must be remembered that they are easily broken, however.—*L. T. Wicks.*

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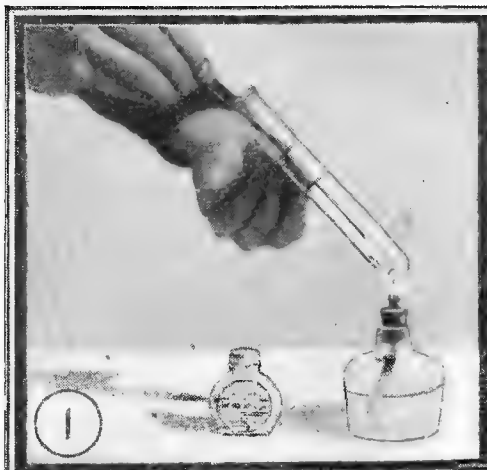
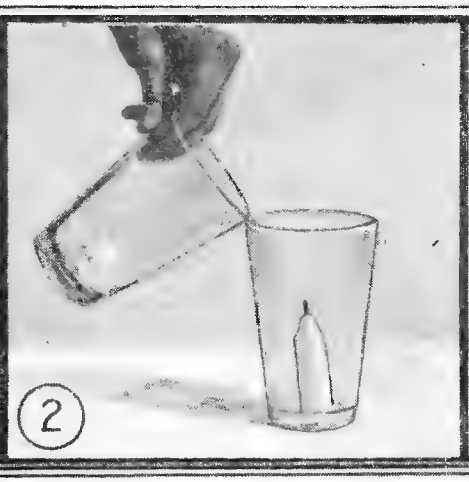
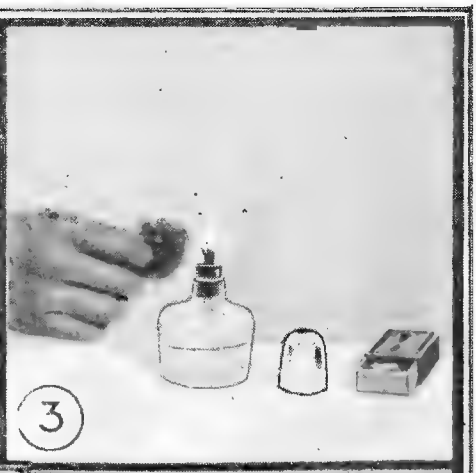
Simple Chemical Experiments

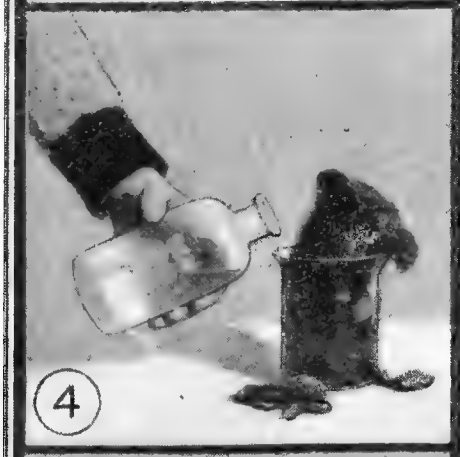
Entertainment at Home with Few Ingredients

By RAYMOND B. WAILES

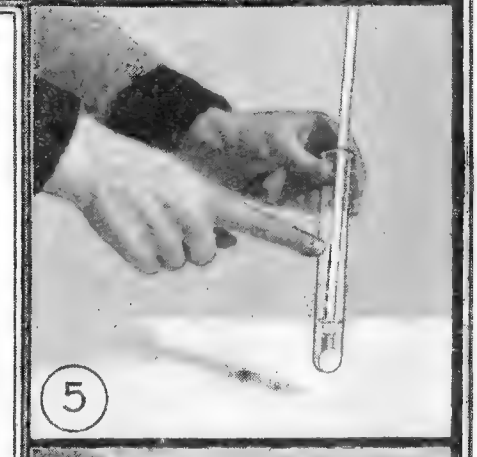


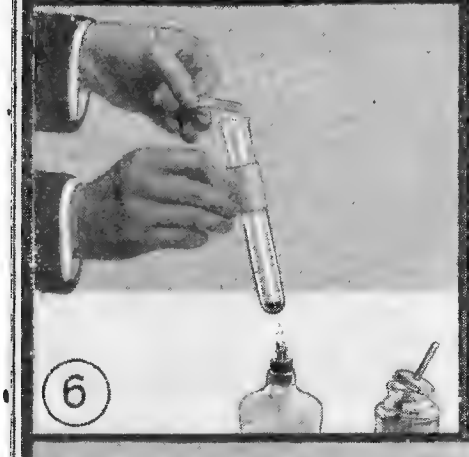


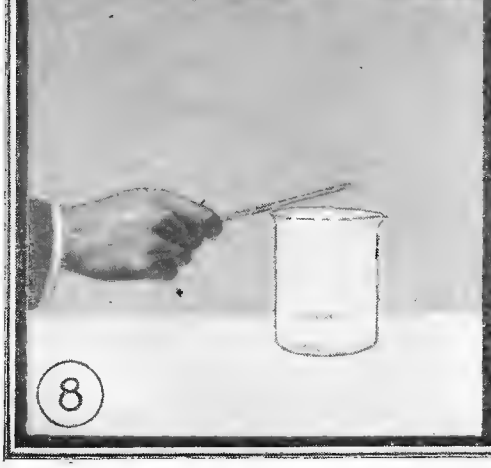


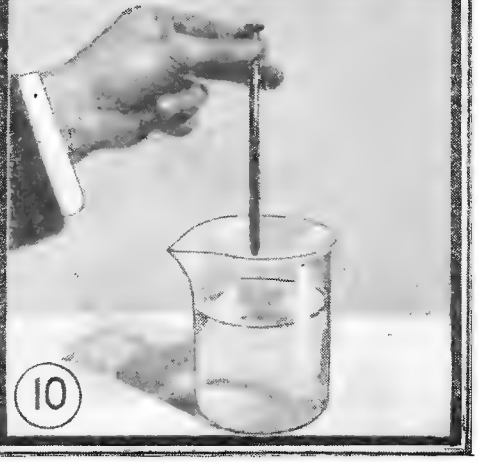


Oxygen gas can be prepared by heating several potassium chlorate tablets in a test tube. A glowing splinter will catch fire with a miniature explosion when placed in the tube, as shown in Fig. 1. Place several lumps of marble in a tumbler and add muriatic acid. Carbon dioxide gas will be given off and it can be poured like water, putting out a candle, as shown in Fig. 2. Iron will burn with a dazzling white light, as shown in Fig. 3, where a tuft of steel wool is held in a flame. Make a strong sugar solution and pour concentrated sulphuric acid upon it. The sugar will become charred and the carbonaceous material will be forced upward, as shown in Fig. 4. Dissolve several pinches of sal ammoniac or of sodium nitrate in a small amount of water. The water falls several degrees in temperature, as ascertained by a thermometer, as shown in Fig. 5. Some substances, like sulphuric acid, have a very high heat of solution. No, glue is not made of horse's hoofs, but both contain a large amount of nitrogenous substances. When either is heated, ammonia gas forms and can be detected by its odor, or by using a strip of moist red litmus paper, which will be turned blue, as shown in Fig. 6. Lemon extract can be tested for its genuineness by pouring several drops into water. If a white cloud forms, it is rather certain that the extract contains real oil of lemon, but if no cloud is produced, it is probable that citric or tartaric acid is used as a base. This experiment is shown in Fig. 7. Below, in Fig. 8, is shown how "ice" may be made by the rap of a lead pencil. Dissolve as much hypo as is possible in hot water, filter, and allow to cool. If the proper ratio of water and hypo has been used, and the temperature is right, the liquid will crystallize out into a mass of crystals if the vessel is struck a blow with a pencil. Lead trees can be made by immersing a piece of zinc in a solution of sugar of lead. A tree-like growth of lead will deposit on the zinc at the end of a few hours or less, as shown in Fig. 9. A thin film of copper can be plated upon iron or zinc by immersing the object in a solution of copper sulphate, Fig. 10.









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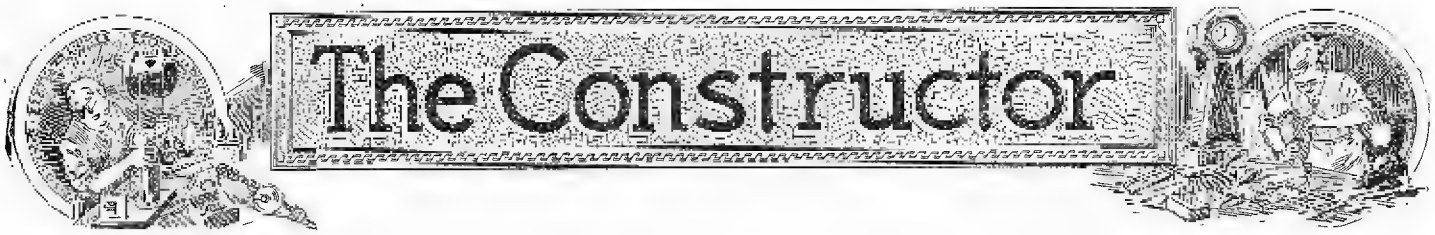
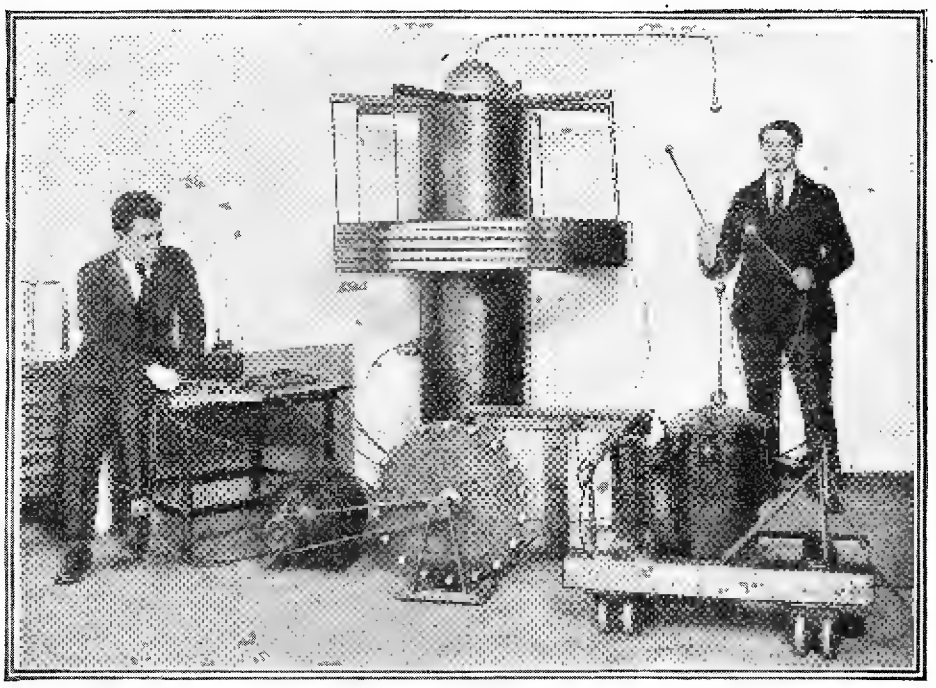


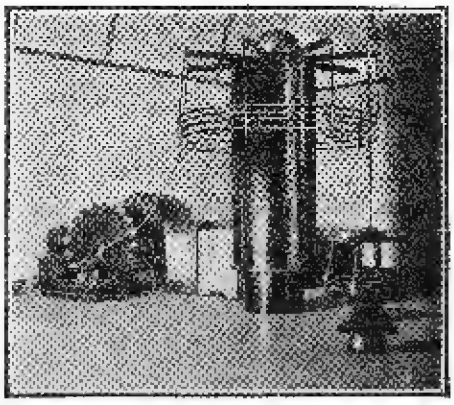
Constructing a Tesla Coil

High Frequency Resonator Is Easily Constructed

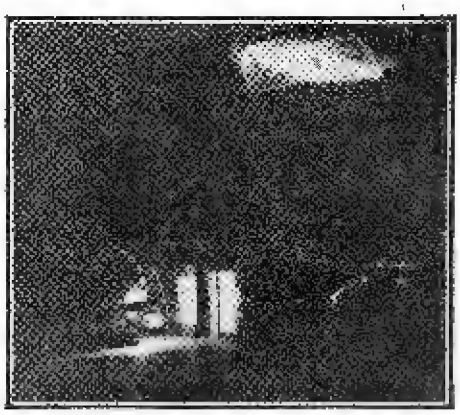
HIGH frequency resonators offer an ideal field for experimentation with electricity of this nature. Either Tesla or Oudin coils may be used for obtaining weird effects and miniature lightning discharges. The former type of coil will be described here. This coil was constructed by students at the School of Engineering of Milwaukee, and used to demonstrate high frequency discharges. The coil is approximately 6 feet high, and the secondary consists of 680 turns of No. 24 D.C.C. wire. The turns are spaced and kept apart by winding cord between adjacent turns. The primary which is placed about the secondary, consists of 4 turns of No. 6 copper wire, or copper ribbon. The coil is mounted in an upright position, with the primary suspended about the secondary and supported from the top as shown. The circuit diagram shows how the coil is connected to the power supply. The transformer is rated at 8 K.V.A. and delivers 22,000 volts. Across the secondary of this transformer a fixed condenser is placed, and is made of plates measuring 10 x 12 inches. Eight sections of plates are used, each section consisting of 5 plates, with the separate sections connected in parallel. The condenser plates are submerged in a good quality of transformer oil. The rotary gap is 20 inches in diameter and has 18 aluminum contacts. The gap is turned at a speed of 1,600 revolutions per minute by an electric motor rated at 2 horsepower. With this apparatus some startling demonstrations and experiments can be carried out. It is important that during these demonstrations the subject stands upon a glass or well insulated platform. With frequencies of a high value such as are produced with the Tesla coil, the reversals of current are so rapid that the current does not have time to penetrate the tissues of the body. The major portion of the current passes over the surface of the body and little inconvenience is experienced. Frequencies ranging from 120,000 cycles to as high as a million cycles are obtained with Tesla and Oudin resonators. The coil shown in the photographs was used to illustrate the effect of lightning discharges upon a toy village. Miniature houses and churches were destroyed by means of discharges of the coil. Startling evidence of how lightning discharges are attracted to sharp metallic points and the function and uses of lightning rods were recorded during the experiment. No iron nails or screws are used in the construction, and the Tesla coil is nothing more than an air core transformer. The building and operation of these artificial lightning generators will bring many thrills and real satisfaction to those who are interested in producing experiments of a spectacular nature.



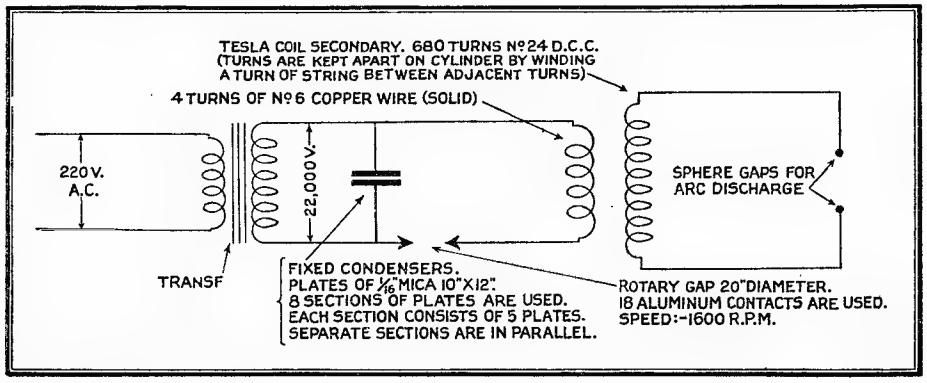
Above is a photograph of the completed Tesla coil, transformer, condenser, and rotary spark gap. The transformer may be seen placed upon the movable truck with the condenser just to the left.



The photograph of the coil in the electrical laboratory appears above.



A photograph of the discharge from the coil is shown here. The electrodes are spaced about 28 inches apart.


TESLA COIL SECONDARY. 680 TURNS Nº 24 D.C.C.
(TURNS ARE KEPT APART ON CYLINDER BY WINDING
A TURN OF STRING BETWEEN ADJACENT TURNS)
4 TURNS OF Nº 6 COPPER WIRE (SOLID)
220 V.
A.C.
22,000 V.
SPHERE GAPS FOR
ARC DISCHARGE
TRANSF
FIXED CONDENSERS.
PLATES OF 1/16" MICA 10"X12".
8 SECTIONS OF PLATES ARE USED.
EACH SECTION CONSISTS OF 5 PLATES.
SEPARATE SECTIONS ARE IN PARALLEL.
ROTARY GAP 20" DIAMETER.
18 ALUMINUM CONTACTS ARE USED.
SPEED:-1600 R.P.M.

Above is the circuit employed with the coil described here. The transformer is air cooled and is rated at 8 K. V. A. The rotary gap is 20 inches in diameter.

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A Wardrobe Cupboard in Plywood

Plywood—a Laminated Wood Stock of Non-Warping Variety—is Suitable for Home-Made Furniture

By J. E. LOVETT

PLYWOOD in its modern form is peculiarly well adapted to the economical construction of many pieces of furniture. It is obtainable in sheets of convenient sizes, in many thicknesses, and it is an aid to economy in woodwork of many kinds.

What is not generally appreciated is the fact that plywood can be utilized directly in constructional work, and that a framework or substructure is not essential.

This facilitates the making of numerous large articles of furniture, such as the wardrobe cupboard (Fig. 1) and others of a similar character.

Hitherto this class of article has been largely framed up, necessitating a number of comparatively intricate joints, and a multiplicity of processes, many of them beyond the scope of the average home craftsman.

Framing up, jointing, and other constructional methods that have held sway for many years can now be modified, and they are often rendered totally unnecessary by the use of plywood, if the full possibilities of the material are appreciated by the designer and the maker.

FORM OF JOINTS

USUALLY it suffices to employ plywood sheets of proper thickness, and to join them at their edges, by such methods as a tongue and groove, feather, or some other joint.

These joints can be glued and clamped up in the usual way, and will never yield or open, thanks to the inherent stability of modern plywood. Shrinkage tests on modern plywood prove it to be immune from contraction or expansion for all practical purposes.

Several notable advantages follow the adoption of the simple constructional method outlined. For example, the exterior and interior faces are formed at the same time, internal blocking is eliminated, and the whole space is available for its legitimate purposes.

The weight is less, as there is a smaller bulk of material, the structure is particularly rigid and enduring, doors and drawers will never warp, twist or jam, and the face of the material itself is for many purposes sufficiently good and attractive to stand an enonomical finish by staining or polishing after sand-papering if necessary.

WARDROBE CUPBOARD DESIRABLE

THE wardrobe cupboard shown closed in Fig. 1 and open in Fig. 2 is a characteristic example of what can be accomplished along these lines.

The simple outlines and broad smooth surfaces, free from applied ornaments, are in keeping with the trend of modern furniture design, and appeal to the housewife, as it is remarkably easy to keep clean and in perfect condition.

Any suggestion of monotony is dispelled by the simple painted motif on the doors and the ingeniously disposed moulding on the edges.

The interior is divided into two portions, one a simple hanging cupboard with an extending wardrobe rail at the top, and the other furnished with three drawers, three trays, and two spacious shelves, an arrangement that is adaptable to most requirements.

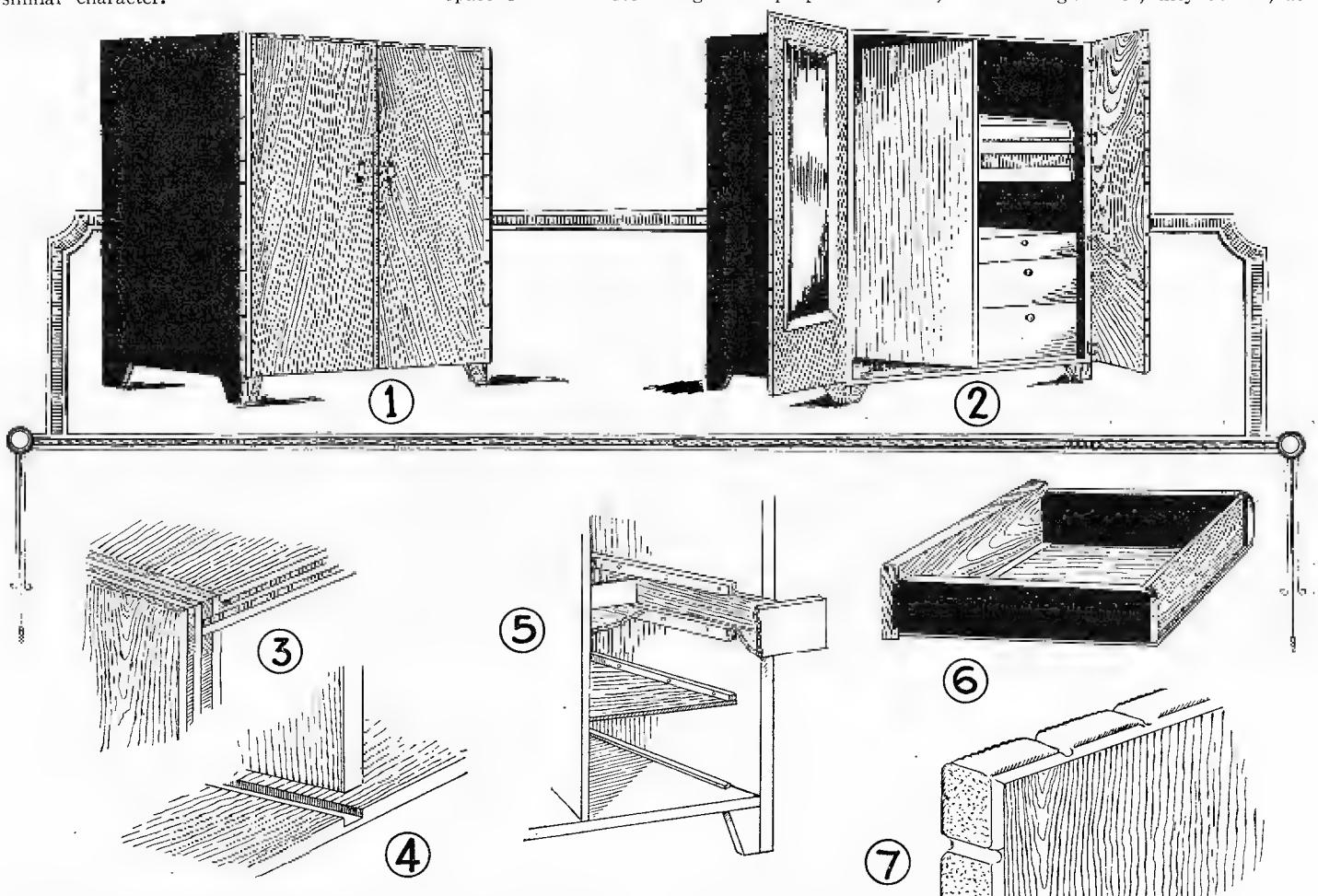
One point to notice is that the doors are hung on the face of the carcase or body work, and shut against it; they do not, as has been customary, close into a frame-work.

This facilitates fitting operations and permits the exposed edges of the plywood to be covered with a neat, simply moulded strip. The doors and trays close within the body in the usual way, but there are no visible crossbars between the drawers, as the drawer fronts are extended to cover them and the ends of the supporting runners.

The feet at the lower sides are formed from the plywood, but those at the front and back are cut out separately and glued into place.

Dimensions for this wardrobe can be modified to meet individual ideas, but a practical article measures 4 feet 6 inches high, 3 feet 6 inches wide, and 2 feet deep, the feet

(*Continued on page* 565)



Figs. 1 and 2 above show the wardrobe cupboard, both closed and open. This is a characteristic example of what can be done with plywood. The surplus material at the bottom of the side pieces is sawed out, in order to form the two legs, as shown in Figs. 1 and 2. In the middle of the top and bottom boards a groove is cut, commencing from the back and terminating ½ inch from the front edge, as shown in Fig. 4.

Fig. 5 shows the position of the runners for the drawers. Fig. 6 shows a simple dovetail joint which can be used. A little decoration can be applied to the fronts of the doors, as indicated in Fig. 7. The notches are filled with old gold.

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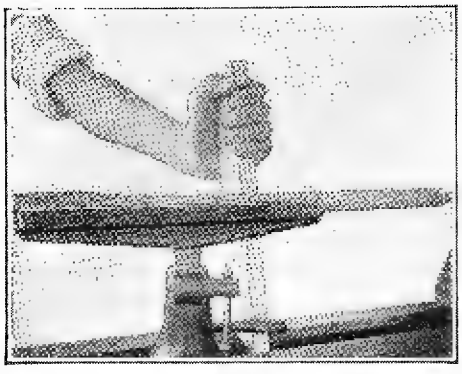
Wood Turning for the Amateur

No. 4 of a Series

By H. L. WEATHERBY

CHUCK WORK

THAT good old game of "The Gay Nineties," croquet, has come back. If you doubt this statement ask at sporting goods stores; or look at their window displays, and you will find croquet sets interspersed with golf and tennis goods.



Get someone to help in turning the handle, by holding a wooden brace lightly against the work as it revolves.

Last month we told you that we would take up chuck work in this issue, and give directions for constructing a ball. In addition to this a group of drawings for a complete croquet set is given, in which either four, six or eight balls may be used. Perhaps it would be best to start with a four-ball set and add to this as occasion demands.

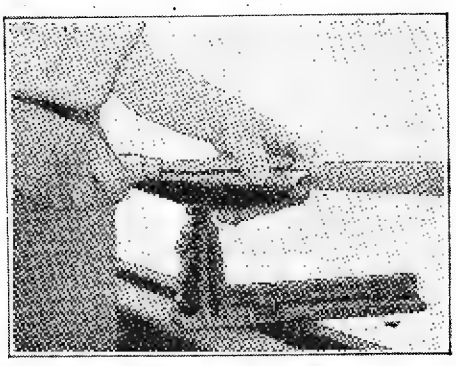
THE MALLETS

THE construction of the mallet calls for simple spindle turning and is identical in its construction with that of the woodworker's mallet; described in the second installment of this series; with but one exception. The handle, being long, will vibrate in the lathe and be somewhat troublesome to turn. There are several ways in which this may be overcome. In the first place, use good, straight-grained ash or hickory, and then do all of the turning on the handle at slow speed. The illustrations will show how the piece may be steadied. Get someone to hold a brace lightly against the work as shown, or grasp the chisel as illustrated, steadying the piece while cutting. An ingenious brace may be rigged up to the bed of the lathe also, where one has a great deal of this sort of work to do. This is simply a split block with a hole of the desired size and height bored in it. In this case the hole would be of the same diameter as the middle part of the handle. This middle portion of the handle is turned to diameter first and then the hole in the split block, which has been slightly greased, is placed around the turned section and the block bolted together through holes already prepared. The brace is fastened to the bed of the lathe and will prove to be an excellent steady-rest if properly prepared.

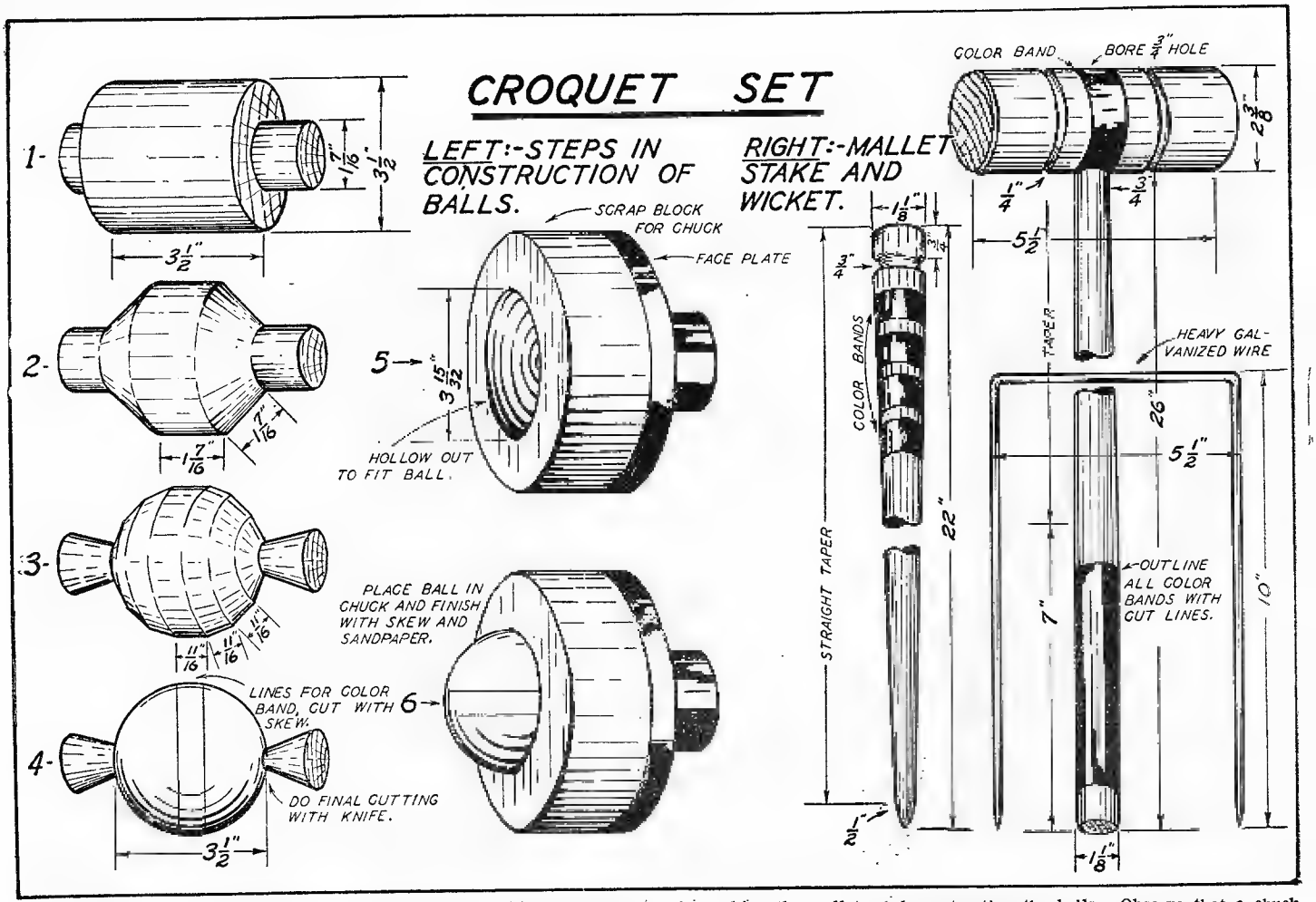
FINISHING

AS the head and handle of each mallet is turned, as well as when turning the balls and stakes, light lines are cut with the point of the skew to locate the color bands. All parts should be well sanded on the lathe, and one ball and one mallet should correspond as to color. Bright bands should be

(Continued on page 547)



It is possible to steady slender turnings by holding the work as shown, after the rough corners have been removed.



The above diagram illustrates the various steps which the amateur will take for making the mallets and constructing the balls. Observe that a chuck in the construction of a croquet set. All of the dimensions are here given for the balls is made from a scrap block affixed to the face plate.

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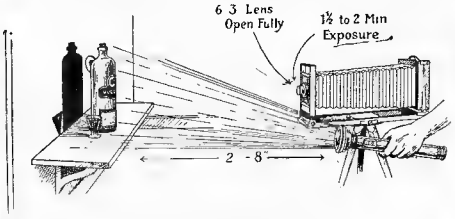
How to make it

ARTICLES OF INTEREST TO EVERYONE

Indoor Time Exposures With a Flashlight

The above photograph was taken in the house at night by means of a powerful five-cell hand flashlight.

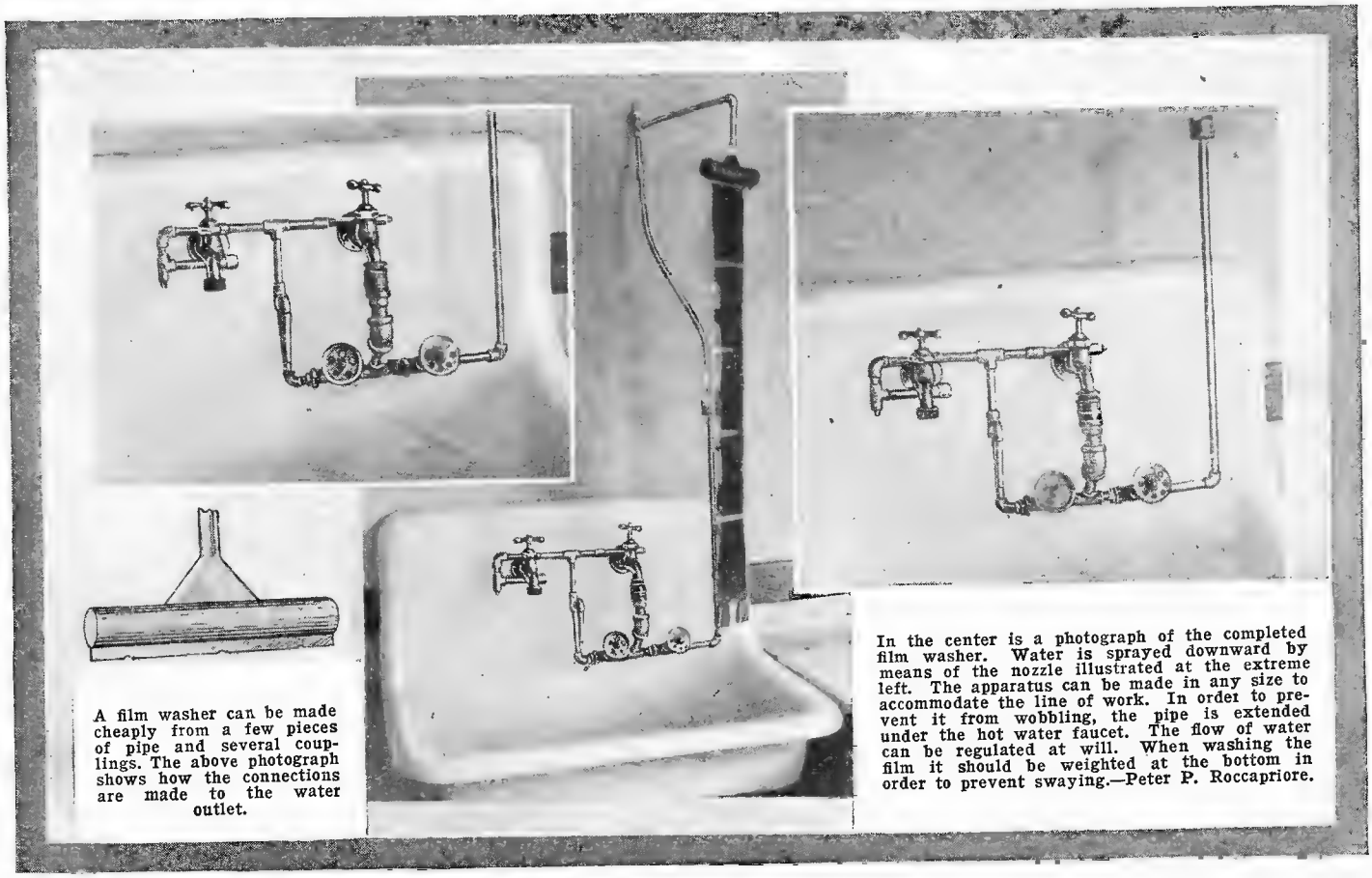
THE amateur has often wished to photograph interior objects, but has been unable to do so because of lack of equipment. From now on, however, by using a powerful electric flashlight, equipped with a focussing cap, indoor pictures can be taken at night. This provides an inexpensive and readily available means for lighting which extends the boundaries of amateur picture making. The photographs shown here were taken with the camera situated about two and one-half feet from the object, and the flashlight placed just to one side of the camera. The room was then completely darkened, and the shutter opened. The light was focused and kept moving throughout the exposure in order to illuminate the object fully. The time of exposure varied from one and one-half to two minutes. *Name of light on request.*



The above illustration shows how the photographs appearing here were taken. The light and camera were placed about two feet eight inches away from the object. The camera, which had a 6.3 lens, was allowed to remain open for about one and one-half to two minutes.

Above is an excellent amateur photograph of still life. This was taken in the manner described here.

Film Washing Apparatus



A film washer can be made cheaply from a few pieces of pipe and several couplings. The above photograph shows how the connections are made to the water outlet.

In the center is a photograph of the completed film washer. Water is sprayed downward by means of the nozzle illustrated at the extreme left. The apparatus can be made in any size to accommodate the line of work. In order to prevent it from wobbling, the pipe is extended under the hot water faucet. The flow of water can be regulated at will. When washing the film it should be weighted at the bottom in order to prevent swaying.—Peter P. Roccapriore.

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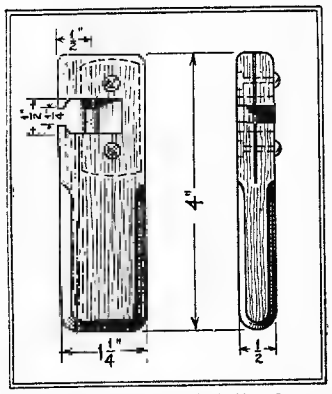
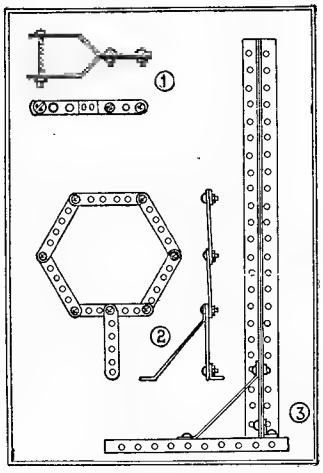
Wrinkles
RECIPES & FORMULAS
Edited by S. Gernsback

POCKET TWINE CUTTER



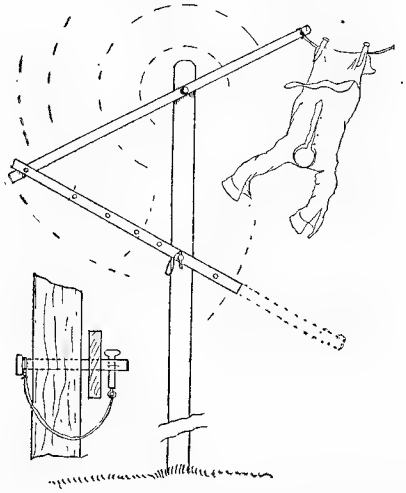
A knife for cutting twine or string which can be carried in the pocket without danger is illustrated at the left. A safety razor blade is used for the cutting edge. A piece of hard wood is drilled and cut, as shown. The blade fits in a slot and the opening for the twine should be small so that the fingers cannot come in contact with the blade. This cutter is especially useful, as it does not have to be opened and closed before or after using.—D. S. Jenkins.

RING STAND



An efficient substitute for a ring stand can be made with various numbers of strips. Test tube clamps can also be made from these parts. The ring or clamp is fastened to the upright, which consists of two strips one foot long.—A. R. Silverberg.

CLOTHESLINE TIGHTENER



The ordinary clothesline is rather inconvenient in that it is often too high or too low for the particular article to be dried. However, by means of the simple device shown here it can easily be raised or lowered.. A lever is cut from hard wood, pivoted as shown, with one end attached to a piece of strapiron. This allows the line to be raised or lowered.—S. Leonard Bastin.

REPAIRING CRACKED CRANK-CASES OR OIL TANKS

Apply a mixture of sulphur and plaster-of-paris; the sulphur should first be melted and then the plaster-of-paris mixed with it. After being well mixed the solution should be poured into place while still hot. It will be found that oil cannot penetrate the crack.—*Contributed by Frank A. Jusaites.*

WATER GLASS CLEANSER

Add enough water glass or sodium silicate solution to a quantity of boiling water to make a mixture the consistency of syrup and keep it in a bottle. If very dirty clothes are steeped in water to which this mixture is added, and are afterwards rinsed out and soaped, they will be very much whiter than if washed with soap and water alone. Very good for removing stains. Test tubes and retorts which have become discolored may be washed in this solution and are made brilliantly clear. Also good for washing marble, pottery or enamelware. Whiting must be added when removing stains from marble. Sponges when washed in a solution of hot water, water glass and then rinsed become beautifully clean and fresh.—*Contributed by F. A. Jusaites.*

SUBSTITUTE FOR GROUND GLASS

Make a solution of Sulphuric Ether 4 ozs., Benzole 2 ozs.; Denatured Alcohol ½ oz., and Gum Sandarac 100 to 150 grs. If this is flowed or painted on a sheet of plain glass an excellent substitute for ground glass will result. And one of the analine dyes may be dissolved in the alcohol before mixing with the other ingredients, if it is desired to make a glass of a special color.—*Contributed by Ivan Haffenden.*

A SENSITIVE COMPOUND

A jolly young chemistry tough,
While mixing a compound of stuff;
Held a match to the vial
And after a while
They found his front teeth and one cuff.
—*Contributed by A. R. Silverberg.*

BLUEPRINT PAPER

The following formula is for a blueprint paper that will give blue lines on a white ground, it is simple to make and gives beautiful results.

Gum Arabic 385 grs.; Sodium Chloride 46 grs.; Tartaric acid 62 grs.; Perchloride of Iron 123 grs.; Water 3½ ozs.

The paper should be coated in the dark room, the solution being brushed on or the paper floated on the surface for a few seconds.

After printing, develop in a saturated solution of potassium ferrocyanide, wash well and fix in hydrochloric acid 1 part to 20 of water.

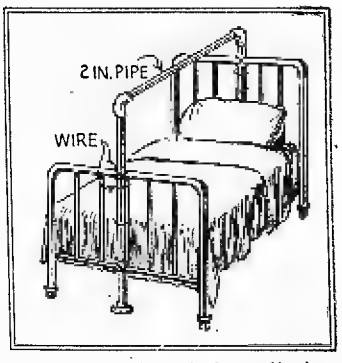
Prints are permanent.—*Contributed by Ivan Haffenden.*

TO FASTEN CELLULOID

Dissolve celluloid scrapings in acetone, heating slightly to clear up. Use as cement.

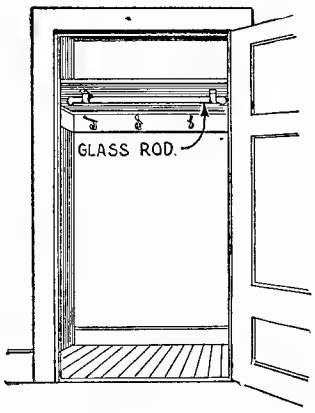
Another way is to moisten celluloid with acetone, press together and put weight on the joint until it dries.—*Contributed by L. A. Collins.*

INVALIDS' AID



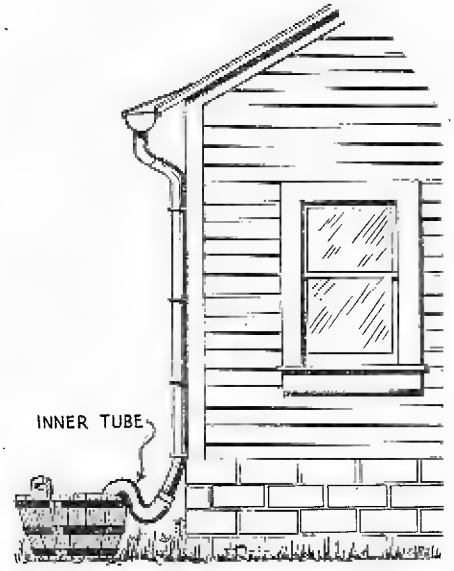
A two-inch pipe, bent as illustrated, and attached to the bed with heavy wire, provides a substantial grip for the patient, who can raise himself by the aid of the iron rod. A suitable base should be arranged on the end of the pipe which rests upon the floor, in order to keep it from slipping. With the provision of an iron rod such as this, patients can and have been handled much easier.—Mrs. J. H. Gachenour.

CLOTHES HANGER



The capacity of a clothes closet can be doubled by installing a glass rod such as those used for towel racks. This rod is simply fastened to the closet shelf by means of screws passing through the rod supports. this arrangement provides plenty of room so that the hangers can be placed at right angles to the walls of the closet.—J. A. Weller.

DRAIN PIPE EXTENSION



When it is inconvenient or impossible to use the present drain pipe, a piece of old inner tube can be utilized in the manner illustrated here. One end of the tube is simply slipped over the drain pipe and the other end is placed in a large tub.—C. N. Penington.

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Readers Forum

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them, whether caustic or not. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words or less, and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

ELECTRO-IONA-METER

Editor, SCIENCE AND INVENTION:

There is a device being used by a chiropractor here called, "The Electro-Iona-Meter," for tracing nerves and picking majors.

This device works on an electric pick-up principle by the patient holding an electrode in his hand and the operator gliding down the spine with a "Finder," the pick-up being conveyed through the body and observed by a squawk in two 1,000-ohm receivers, one on the patient's head and one on the operator's head.

Being a student of radio matters, I have tried to figure out the connections of this, and why it would pick up one nerve and not another, whether the nerve was imagined or not, and for this reason I am writing your department to ask if you can furnish any information regarding it.

H. O. GRIGGS,
Winslow, Ariz.

(The Electro-Iona-Meter does not increase its reading or decrease the reading when located over a nerve where there is supposed to be a subluxation. The only thing that this device will do is to measure the resistance of the body between the electrode and the point of contact of the explorer or finder. When the bridge is unbalanced, a squawk is naturally heard in the receivers. However, moistening any spot on the back with a drop of ammonia, squeezing the skin between the fingertips, causing a slight abrasion, scratching the skin with a pin or needle, or using a little vinegar on the skin at any point desired, will cause a sound to be produced; even where one had not been hitherto. The chances are that the sound would be greater in volume than at the point of the supposed subluxation.

The machine itself is made practically in the form of a Wheatstone bridge with a phone substituted for a galvanometer and the body serving as the "X" arm.—EDITOR.)

JOINT SNAKE

Editor, SCIENCE AND INVENTION:

I have frequently heard my grandmother tell the story of her encounter with what she calls a "joint snake." After having read the article about animals in the August issue of your magazine, I decided to write to you and find out what I could about it.

She says that she struck a snake that was lying in the road and that in doing so she broke the snake into several pieces. She went out and got several neighbors to come and see the snake, but upon returning, it was gone. One of the neighbors seemingly knew just what it was. He said it was a "joint snake" which had, as was frequent with it and others of its kind, loosened the joints of its body when struck, and gathered them together again, upon being left alone. This snake was rather a small one.

I can hardly swallow all this and I would like very much to have the opinion of someone else upon it.

I am a comparatively new subscriber to SCIENCE AND INVENTION, and am quite young, too, but it interests me greatly. I enjoy the magazine from beginning to end, and am always waiting for the next issue.

KELSEY CHAS. MILNER,
Chicago, Ill.

(Fables record joint snakes, but from the standpoint of the scientist, such a thing does not exist. It is impossible to break up a snake into pieces by striking it, and it is further impossible for any snake to collect its pieces together again and ramble off. Not even a human being with surgical skill could reassemble a snake cut into several pieces and expect it to live thereafter.

What really happened in the case your grandmother spoke about, was that some predacious bird, some larger snake, or some animal, such as a dog or a cat, ate up the pieces or carried them off. It is possible that the individual who took part in this event never went back again to the same place where he had killed the snake, or else the snake was merely stunned instead of killed and managed to crawl away into nearby weeds. The whole story smacks of fable.—EDITOR.)

RELATIVE ETHER

Editor, SCIENCE AND INVENTION:

Being a constant reader of your magazine, I notice in your July issue a caustic comment on Sir Oliver Lodge's, "Ether and Reality," by Mr. Lockner, who knows nothing about science. While trying to disprove an hypothesis which Mr. Lockner himself does not know, he makes himself ridiculous, and funny.

For instance, he said that if ether is perfectly dense, perfectly rigid, perfectly elastic, perfectly continuous, perfectly weightless, perfectly frictionless, therefore it must be perfectly ridiculous. I know nothing about ether, but still I believe it may possess those opposite attributes without the theory being ridiculous. Take for instance, a line. A line can be straight and at the same time curve, and any scientist knows that it is not ridiculous, because it is a fact.

In another part of his letter he said that since sound waves travel four times faster in water than in air, which is less dense, therefore he concludes, according to Sir Oliver Lodge's hypothesis, that sound waves ought to travel a million times faster in ether. This argument is illogical, for a sound wave is hampered when two or more different densities are met with along its path, unless the sound wave is imparted at the same time to those different densities. He can prove this, if he dives under water and lets someone fire a pistol in the air. While under water he will find out that the report of the shooting is not heard at all. So a sound made by any planet cannot go beyond the planet's atmosphere, but only be reflected back. If you are in a closed room, you cannot very well hear a person talking outside your room, for a dense wall is between the speaker and the hearer. On the contrary, this seems to prove that ether is dense, for sound waves do not go beyond our atmosphere.

In another part of his letter he said that if ether is dense, why then, does it not strip the earth of its light, gaseous atmosphere? Another absurd argument. This is just like saying that if the atmosphere presses upon us with fifteen pounds to the square inch of surface, why are we not crushed walking through it? Or why are not the tentacles of a jelly-fish stripped from its body while swimming through the water?

In conclusion, I may say that I read so many theories and hypotheses about ether; yet no scientist has dared contradict them for lack of proof.

A. E. BENEDICTO,
Menlo Park, Calif.

(Why use ordinary "relativity" arguments to sustain Sir Oliver Lodge's contention of ether? With respect to ether, there is no possibility of looking at the substance from two different angles. We cannot look at ether as a relative ether, and at the same time approach it from the side of a scientist.—EDITOR.)

AMAZING STORIES

IN OUR OCTOBER ISSUE:

THE MENACE OF MARS, by Clare Winger Harris. Most of our readers will note with pleasure this announcement of a new story by Mrs. Harris. In this tale, the structure of the atom and the analogy of the planetary systems of the universe thereto, and cosmic changes affecting the earth disastrously, are all treated in a most instructive manner. And through it all, in the author's own style, runs a thread of romance.

THE VOYAGE TO KEMPTONIA, by E. M. Scott. Certain irregularities of our moon's motion have led some of our astronomers to believe that there is another body—small, to be sure—between the earth and the moon. Around the idea of this extra-terrestrial body is woven an absorbing tale of unusual interest.

THE SKYLARK OF SPACE, by Edward Elmer Smith, in collaboration with Lee Hawkins Garby. (A serial in 3 parts) Part III. In the concluding chapters of this story, our author confines the travels of the Skylark to their newly discovered planet, the inhabitants of which seemed to have made marvelous strides in mechanical science, but falling short of the advances in atomic theories and chemistry made by the Earth people. Our author tells of truly wonderful devices, and very deftly includes the human interest element.

TO THE MOON BY PROXY, by J. Schlossel. The mechanical man, to most of us, seemed nothing more than a far-fetched dream only a short time ago. Yet today we have not only "the silent salesman" and "automatic change maker," but we actually have a mechanical man—a product of the Westinghouse Electric Company—who will start your vacuum carpet cleaner, answer your telephone, etc.

INTERPLANETARY COMMUNICATION

Editor, SCIENCE AND INVENTION:

I dislike to spoil a beautiful mental illusion. I realize that, "Those Who Do Not Go Beyond Fact Rarely Go As Far As Fact."

In your article on "Interplanetary Communication," I must call you back to earth, our starting point. Imagination is a wonderful thing, a product of ages of mental development. We should not overindulge in this wonderful thing, imagination, or we will leave a doubtful impression on the public as to the truthfulness of invention and science.

I must say that your imaginary radio communication with other planets will never be accomplished. Do not get me wrong. I do not say that interplanetary communication will never be accomplished. But I do say that the magnetic radio that we now have will never do the job.

It will be just as impossible to communicate with other planets with magnetic radio as it is to talk across the ocean through a wheat straw. We must have a different tool than magnetic radio to have interplanetary communication. At present it looks as though light radio is our only hope of interplanetary communication.

The magnetic lines of force of the earth are limited in number and extent. The farther away from the earth we get, the less number of lines of force there will be until there are not any. At least a magnetic radio wave, as we know it, would not travel on such few and far between lines of force.

A. B. BLANKENSHIP,
Williamson, W. Va.

(While you have advanced several arguments concerning the impossibility of interplanetary communication by radio, you have given no reason for those arguments, nor have you based these arguments on any scientific reasoning.

The amount of energy actually transmitted into the air by any of our modern broadcasting stations is quite minute. A 5-watt station, transmitting on short waves has been heard in Australia consistently. The individual doing the transmitting was located in Chicago. With this 5-watt transmitter two-way communication was quite continuous. We can reasonably predict that if 5 watts can send a message ten thousand miles, 10 watts in energy should be able to do half again as much. There is, therefore, nothing in the way of communication with Mars or any other planet, unless it be the Heaviside layer, which apparently reflects radio waves. On the other hand, unless the Martians, if such people exist, are familiar with our methods of radio communication, they would also be unable to receive messages unless they had eyes; and unless they also had telescopes, they would likewise be unable to see any light signals which we may send. If they are further advanced than we are along the evolutionary scale, then they know that this earth is inhabited and they are probably aware of every effort which we may make in attempting to establish communication. It is probable that their telescopes are so powerful that they can pick out a spot as big as a city block and observe the people thereon.

You must remember that a radio wave does not require any magnetic lines of force on this earth for its transmission. This wave will penetrate an area entirely shielded from the earth's magnetism. Magnetism and electricity in accordance with modern scientists' opinions, has practically no weight. With a powerful magnet, you can do a lot of attracting or repelling, or with electrical charges you can do likewise. But there is much difference between charges and weight. Inasmuch as both magnetism and electricity are electronic forces, the weight of magnetism depends directly upon the number of electrons present. Each individual electron weighs .000,000,000,000,000,000,000,000,000,089,7 grams.—EDITOR.)

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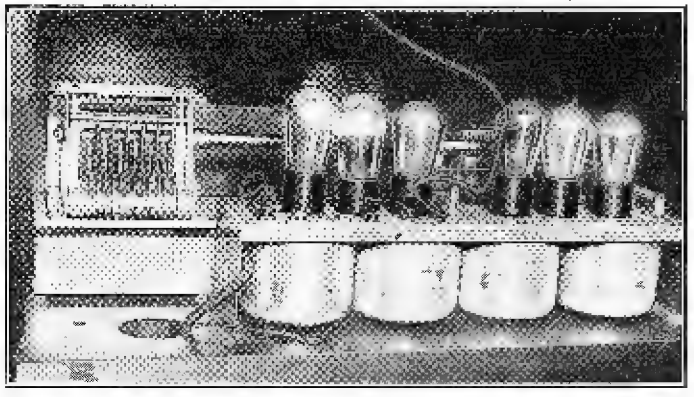
Automatic Tuning

Stations Selected Mechanically with Buttons or Levers

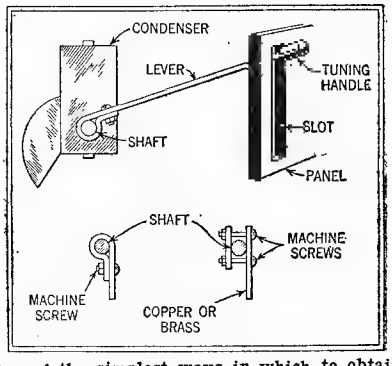
Above is a photograph of a new receiver which uses an automatic tuning system. A number of levers are used for controlling the tuning.



A rear view of the automatic receiver is shown here. At the left may be seen the tuning unit to which the levers are attached.

THE automatic tuning of radio receivers has often been thought about and tried out innumerable times. Remote control systems and complicated arrangements of relays and magnets are rather beyond the average set owner and are usually too expensive and complicated to employ. At least two manufacturers are making sets using an automatic tuning device and undoubtedly many will follow suit in their new models.

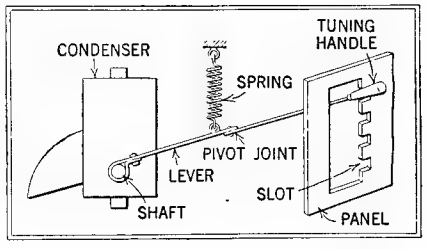
Following the example of the manufacturers the fan will want to try this out for himself. Therefore, several methods whereby this may be accomplished are illustrated and described here. Those shown are simple in nature and can be made with little trouble at a small expense. All the necessary parts can be made at home, probably from materials found in the junk box. All methods are, of course, more suitable for use with single dial sets, but there is no reason why they cannot be used with multi-dial receivers.



One of the simplest ways in which to obtain automatic tuning is illustrated above. The lever is set to the desired station indicated next to the slot.

LEVER CONTROL

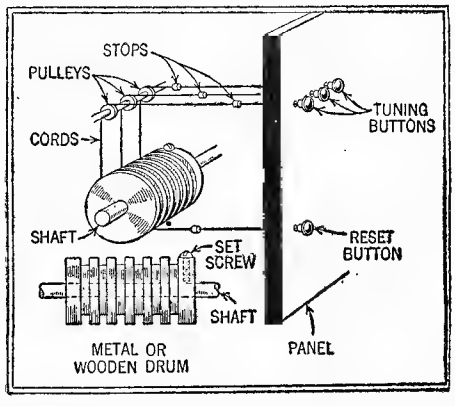
ONE of the automatic arrangements consists in fastening a metal strip to the shaft of the condenser or condensers. This is used as the tuning lever and should project a short distance through the panel, a slot being provided as shown. The call letters of the stations are marked next to the slot, their position being determined by experiment when the system is first put to use. To tune in a station it is merely necessary to shift the lever to the desired station call letters. The end of the lever should be fitted with an insulated handle. The metal strip is bent around the shaft and fastened with a machine screw, or an optional method uses a short strip placed on the opposite side of the shaft from the long lever.



The illustration at the left shows a method which can be employed for tuning the set automatically. Only one lever is used for selecting stations, that is, on single-dial sets. Multi-dial receivers will have the same number of levers as there are dials, the tuning lever simply replacing the dial.

A variation of this system uses a pivoted lever as illustrated. The panel slot has indentations on one side, each one being used for a station. A spring returns the lever to a so-called neutral position when not in use. To tune, the lever is pulled down opposite the desired station slot and engaged in the slot. The pivoted shaft allows this to be done easily. Five slots for the major stations are probably all that the average person will want. To tune out a station the lever is pivoted back so that it runs in the main vertical slot.

The third system of tuning differs from the two preceding ones in that it uses buttons for tuning. A metal or wooden drum is slotted as shown and fastened to the shaft with a set screw. From each of the slots a cord runs over a pulley and through a small hole in the panel. To the end of each cord a small knob or button is fastened, and is pulled out to tune in a station. Stops on each cord allow the buttons to be pulled out just so far. Each button turns the condenser shaft a varying degree and thus allows different stations to be tuned in. A reset button is provided to return the condensers to neutral position. This must be done each time a new station is to be tuned in and is accomplished by pulling out the reset button. In order to take up the slack on the cords small springs or weights can be used.



Buttons are used in the automatic arrangement shown above. One button is used for each station.

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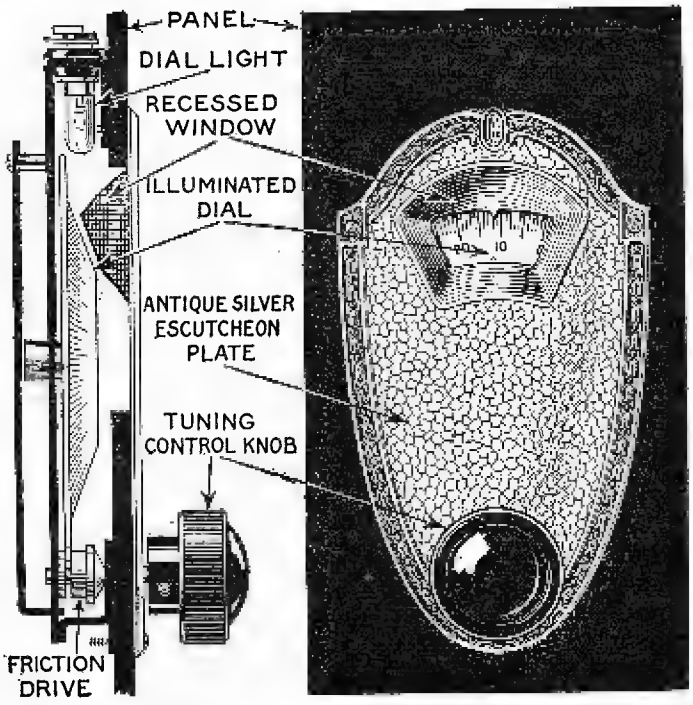
NEW RADIO DEVICES

Accessories Recently Developed Which Will Be of Value with Any Radio Set

ILLUMINATED TUNING CONTROL

ONE of the New England radio manufacturers has recently brought out a new dial of the illuminated type. When tried with a number of different types of condensers, positive control was secured at all times. Due to the fact that a friction drive is used, there is no slipping or backlash. The dial is easily adapted to any receiver and can be mounted with little trouble. A large hole, of course, will have to be made in the panel to provide for the recessed window and three small ones for mounting screws and control knob shaft. An antique silver finish escutcheon plate is provided for the panel and forms a pleasing artistic contrast with black tuning knob when set against a black or mahogany front panel. As the tuning knob is turned the illuminated scale moves across the window. The scale or dial is made of metal and the light from the small lamp is reflected from the surface. The position of the lamp can be seen in the accompanying drawing. This is a novel point in the construction as the usual method used in illuminating dials consists in employing a semi-transparent material, such as celluloid for the scale, placing the lamp behind it. The dial light is easily removed for replacements as it is placed in a readily accessible position. The rugged construction of the dial insures long life and good service, regardless of whether it is used with single or gang condensers, or for varying the coupling between inductances. A steel frame supports the scale and lamp and is held to the panel with the mounting screws. With single control sets or with sets having more than one control, the dial leaves nothing to be desired in the way of performance or appearance. Its real worth probably lies in the fact that it can be substituted for the dials used on the set at the present time without injuring the panel in any way.

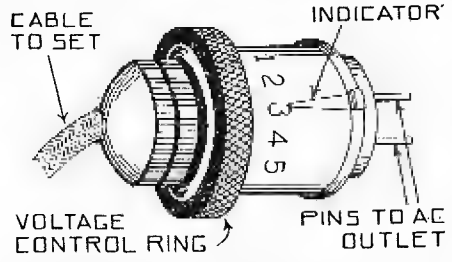


The above illustration shows two views of the new dial. The antique silver escutcheon plate lends a touch of beauty to the receiver.

The illustration shows the details of construction, with the major parts indicated. Both a side and front view appear here, showing how the dial is mounted and front panel appearance. It is frequently a matter of taste as to whether this type of dial or the edgewise drum type be used.

VOLTAGE REGULATOR

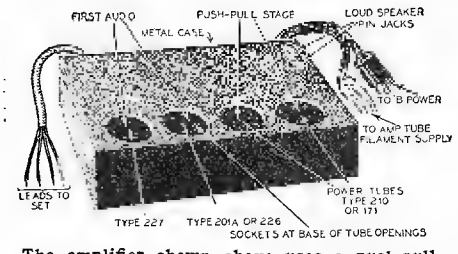
A PHILADELPHIA concern is now making an A.C. voltage regulator of compact and efficient design. This is plugged into the light socket and the voltage control ring is turned to secure the proper regulation. Tubes are thus protected from excessive voltage. An indicator is provided and cable to set is plugged into the device as shown.



The A.C. voltage regulator is shown above. Excessive line voltage is compensated for by turning the control ring. The device is plugged directly into the light socket.

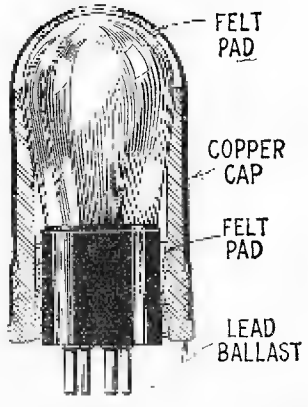
PUSH-PULL AMPLIFIER

FOR those who desire a powerful audio amplifier, to which the detector output or phonograph pick-up is attached, a New Jersey manufacturer has developed the push-pull power amplifier shown here. It can be operated from an A.C. source of supply or from batteries. Either a type 227, 226 or 201A tube can be used in the first audio stage, both five and four-prong sockets being provided. Type 210 or 171 tubes can be used in the push-pull stage. Cables for filament and plate supply, and for the input have been provided. The apparatus is housed in a metal case which fully shields and protects it. Loud speaker pin jacks are placed on the top near one end, as shown. The amplifier measures 3⅛ inches high, 6⅞ inches wide and 11⅜ inches long. Through the use of a push-pull stage A.C. hum and distortion from tube harmonics are reduced to a minimum. With a 226 or 227 type tube it can be A.C. operated.



The amplifier shown above uses a push-pull stage and provides for the use of either a type 201A, 227 or 226 tube in the first stage.

TUBE BALLAST

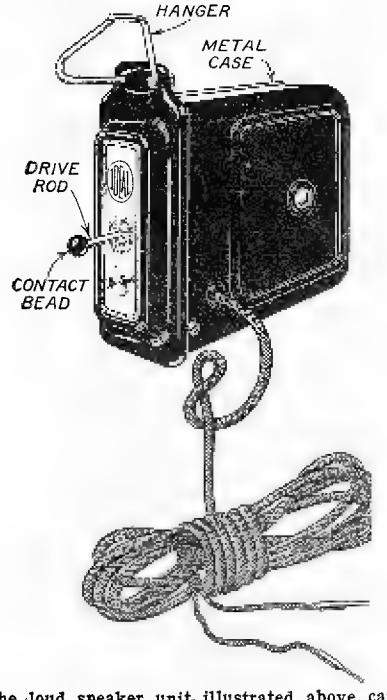


The tube ballast and the manner in which it is used is shown above. Felt pads prevent vibration of the device.

A LEADING Western radio company has placed a new tube ballast on the market, which positively checks any tendency of the tube to howl. A tapered lead ballast partly threaded fits over the tube. Over this a copper cap is placed.

SPEAKER UNIT

A LOUD-SPEAKER unit of unusual design has been made available by a New York manufacturer. It is intended to be held against a surface capable of vibrating and acting as a radiator. The device is housed in a metal shell which protects it from damage, dust and moisture. A hanger is provided so that it may be attached to any surface desired. The tip of the drive rod is provided with a ball of hard material. This is pressed against the surface to be used as the radiator.



The loud speaker unit illustrated above can be used with almost any surface capable of vibrating.

Names of manufacturers supplied upon request.

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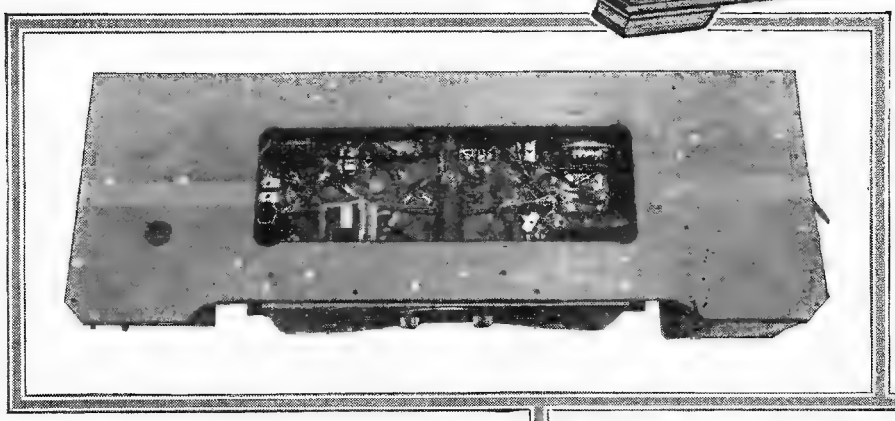
A NEW SOCKET POWER SET

Provision for Phonograph Pick-Up and Ease of Control Show Advanced Design

ANOTHER electric radio receiver for the public to choose from has recently appeared in a number of new models and is made by one of the pioneer electric set manufacturers in New York City. The receiver operates entirely without batteries and is simply plugged into the nearest base plug or wall socket. It will take any average variation of alternating current and several models are also made for D.C. light socket operation. The receiver is a complete self-contained unit inasmuch as the "A" and "B" eliminator are encased in the cabinet. Five 199-type tubes are used with a 210 power tube in the last audio stage. Another added improvement is the provision made for a phonograph pick-up. Two tip jacks, into which the pick-up unit can be plugged are arranged on the sub-panel. By throwing a small switch, the radio receiver is turned off and the audio amplifier can then be used with the pick-up for amplifying phonograph programs. Thus, any phonograph record can be amplified and reproduced with better quality through the use of the radio set.

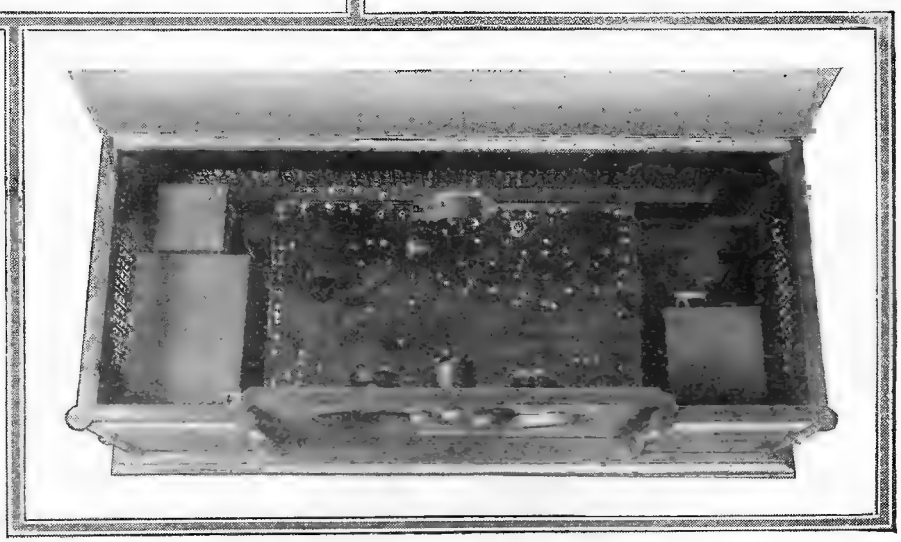
Above we see the all-electric receiver in operation. The volume can be regulated to a mere whisper by the turn of a knob, but the true tone is still retained. A front view of the receiver is shown at the right. The cabinet is finished in burled walnut. A bottom view which shows the coils and tuning condensers may be seen below. At the bottom of the page is a photograph showing the interior layout of the receiver.

Name of manufacturer supplied upon request.



ON the front panel of the set, there is a meter and a knob which permits accurate regulation of the voltage, so that the tubes receive only the required voltage and thus their life is considerably longer than in ordinary receivers where the tubes are fed with more current than is recommended by the manufacturer. Fluctuations in line voltage are taken care of by a power rheostat which is placed in series with the primary of the power transformer. This rheostat cuts the voltage so that by turning it until the meter shows the proper reading, standard conditions are obtained. Due to this fact, the set may be plugged in on alternating current voltages ranging from 100 to 130.

IN the photo at the right the electrolytic condenser and filter system may be seen housed in their metal cabinets on the left-hand side of the receiver. The power transformer and rectifying tubes are placed to the right of the set. For rectification two type 281 half-wave rectifiers are employed. The set itself consists of three stages of radio frequency, detector and two audio. The radio frequency system uses two stages of tuned and one stage of untuned radio frequency. The audio frequency end consists of two stages of transformer-coupled amplification and an output device which is a choke and condenser. The voltage applied to the plate of the 210 power tube is about 400 volts and fine quality and great volume is thus obtained. The condensers employed in the filter portion are tested at 3,000 volts in order to insure that they will not break down under any conditions. The receiver has but two knobs for tuning with illuminated dials.



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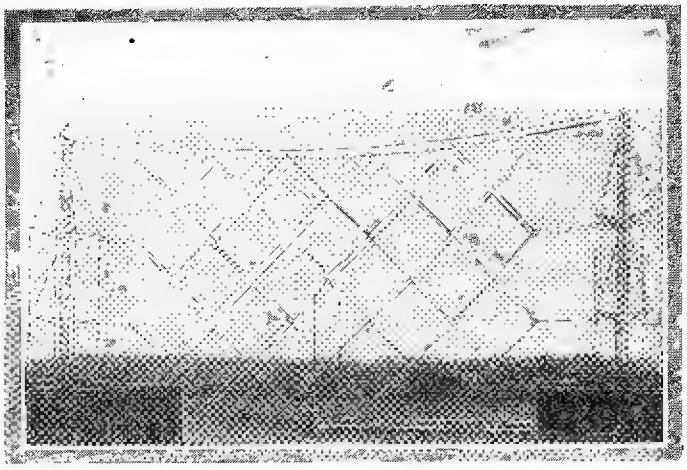
New French Beam Radio

Double Antenna—Projector and Short Waves Used Between Paris and Algiers



At the left is a photograph of the double projecting antenna erected at St. Assise for radio telephonic transmission toward Algiers. This combination antenna-projector is formed by a metallic trellis stretched vertically between two supports about twenty feet high, the sides of the meshes being equal to one-half the wavelength. Short-waves, 30 meters in length, are used for communication.

FOR radio conversation between Paris and Algiers 30 meter waves are employed. The characteristic of the system consists in the use of a new type of reflector, which has been developed by Mr. Chereix and Mr. Mesny.

The combination antenna-projector is formed by a curtain forming a metallic trellis stretched vertically between two standards about 20 feet high, the sides of the meshes being equal to one-half the wavelength. If a single network is used, the waves divide on one or the other lead. But if a similar trellis is suspended in a parallel plane, one-quarter of a wavelength behind and facing the receiving station, this last becomes a reflecting screen and projects the waves coming from the first trellis, which is the one connected to the transmitter. The energy expanded is then projected entirely in the direction of the corresponding receiving station, and by using sufficient power at the transmitting end, the receiving station collects an excess of energy for operating the regulating arrangements which are relied on to automatically reestablish the equilibrium where the telephonic lines enter which serve the radio station.

Finally, according to whether the first or the second trellis is supplied with power, the waves are transmitted in one direction or in the other. Another remarkable peculiarity is that as slight irregularities in wavelength have an influence which is very slight on the action, a single system of antenna can be used for super-imposing several simultaneous emissions.

Now if we utilize waves of thirty meters in length, the meshes of the antenna should be fifteen meters on a side, and the rear antenna should be at a distance of 7.50 meters. Marconi has constructed recently in England a station giving radio telegraphic communication to Canada, using waves of one hundred meters in length, and a power of twenty kilowatts in the antenna. To obtain this remarkable result the celebrated inventor uses reflecting antennas, forming a curtain of about 360 feet long and 48 feet high.

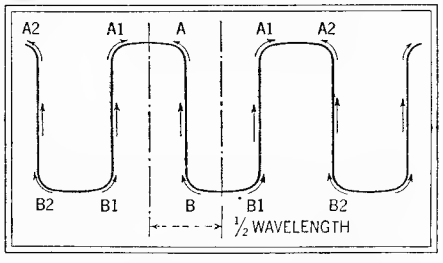
The new radio telephonic transmission station is installed at St. Assise. This station is connected with the central of Paris which establishes connection for the subscribers. At the present time only one way communication has been established. The results appeared conclusive and in the near future bilateral communications will be established, and from any point in Paris, or even in France conversation can be carried on with Algiers or with any point on the north-African lines, the secrecy of communication during the radio electric transmission being secured by special apparatus. In this first experiment for obtaining a perfect connection, a power of twelve kilowatts was utilized.

These telephonic conversations will facilitate in a large measure the development of commercial relations between France and north Africa, and in consideration of the results obtained, there is a possibility of applying the new system to much longer distances. Some important facts concerning the beam have been extracted from *l'Illustration*, France.

The projector is based on the following principles:

A curtain of vertical antenna A B: A1 B1; A2 B2, etc., is traversed by a series of high frequency currents from the station and in the same direction which enables the projection of a beam of 30 meter waves, which is narrow and goes to great distances. This antenna, first devised by Mr. Chereix, enabled Mesny to obtain the supply of all the vertical members of the curtain of antenna by the aid of a simple generator, or by means of two independent generators supplying respectively the two sides of the curtain so as to better equalize the energy over its whole surface.

It is also found that if the wavelengths produced by these two generators are not absolutely equal, their synchronism is produced automatically. Insulators carry the conducting wire in zig-zag shape. This is the emission curtain. In this zig-zag of wire the distance between the centers of two horizontal sections is equal to a half wavelength. By charging the central line A B, in the center, a regular distribution of high frequency alternating currents on all the vertical and horizontal members results, but the currents being of opposite direction in the horizontal sections AA1, BB1, etc., one neutralizes the other. The only radiation left comes from the vertical elements which

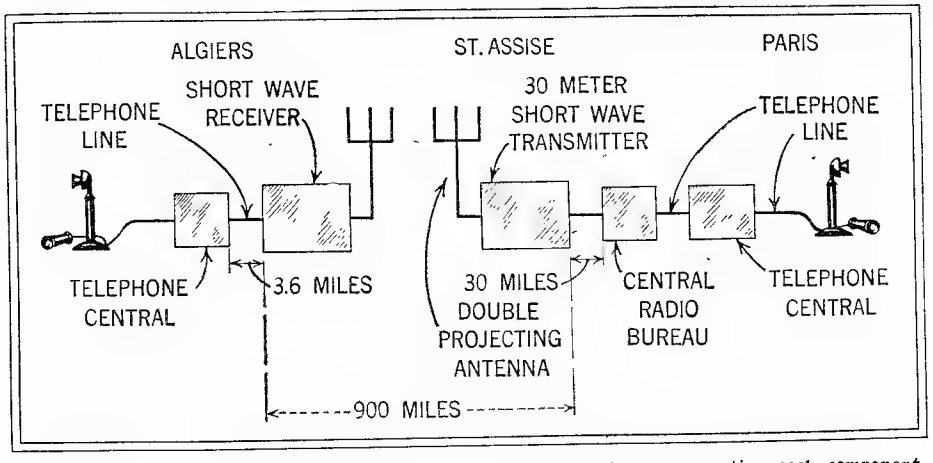


The above illustration shows the operation of the double projecting antenna which is further explained in the text.

superimpose their effect at a distant point. It has been proved that it is useful to round the angles of the zig-zag line so as to reduce the effects of the variation of the electric constants, which appear at sharp angles diminishing the efficiency of the projection, according to *La Science et la Vie*.

We can easily see that if we could concentrate the waves emitted by such a broadcasting station as that of the Eiffel Tower, in a definite direction, say to the United States, and so as to cover a very small surface, such as that of New York, it would require relatively low power to obtain the same results as with the existing stations whose energy spreads all over the globe. And if the surface covered at long distances was reduced to a few square meters only, we would have a complete secrecy in communications; on the other hand the application of rotating beams would be of great assistance in long range directional work for determining with precision the position of ships on the sea and that of flying machines. Those devoted to extra-terrestrial communications would have undreamt of means of such explorations. Thanks to the remarkable researches of M. Mesny, professor of hydrography of the French Marine, at this time, France has simple electromagnetic projectors, which cost little and are adapted for waves as short as three meters in length.

This directional method of radio communication opens up a new field for secrecy in radio telephony. Using the Bell Lab. system of inverted speech and the narrow beam directional radio transmitter, complete secrecy will be insured.



Above we see the complete radio telephony system and the distances separating each component.

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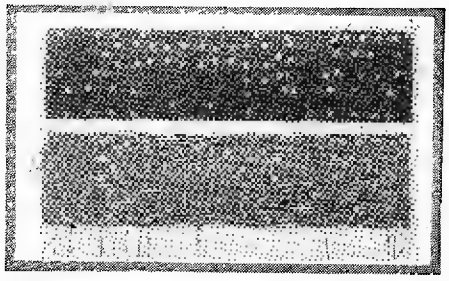
Radio Construction Simplified

By S. R. WINTERS

The above illustration shows Mr. B. Daniels with a five-tube receiver which was wired in 30 minutes by using his new invention. This wiring unit reduces hours to minutes in building sets and when put on the market will cost less than one dollar.

"BUILD your own" is an inviting phrase to thousands of radio constructors, and to as many more it is an uninviting slogan because of the bewildering complications involved in wiring a radio receiver. This confused mass of wires which has stifled the ambitions of many would-be radio constructors, is now simplified by a wiring unit designed by Mr. B. Daniel, formerly of the Radio Laboratory of the U. S. Bureau of Standards. If you are not one of the dyed-in-wool experimenters to whom the intricacies of set wiring is fascinating, this new unit will introduce you to the art of building radio receivers without making costly or unnecessary mistakes. The new wiring system, for which patent applications are pending, does not altogether deprive one of the satisfying thrill of having made his own.

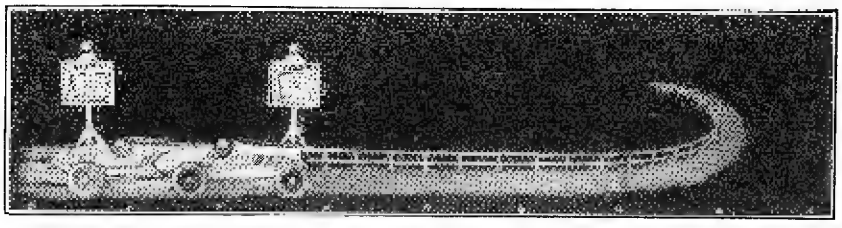
A socket wrench and a screw-driver are the only necessary parts. The soldering task is already done and the amateur simply has to make the mechanical assembly which, according to the inventor, requires only 30 minutes and you have a new receiver. Mr. Daniel has particularly adapted the wiring unit to 5-tube outfits, but it can, of course, be applied to receivers of any other design. The wiring diagram is eliminated when the maze of wires have already been properly placed. Thirty minutes is the allotted time for constructing a 5-tube receiver and the cost for material is estimated at less than one dollar. The inventor claims that while the needs of the novice are specifically served, professional set builders will welcome the new wiring unit. It would enable them to increase their output of radio receivers and at the same time make a neater job. As seen in the photograph, the mounting screws with lugs attached have all been wired properly for the particular type of receiver, in this case a 5-tube set of conventional design.



The above photograph shows a top and a bottom view of a sub-panel which has been arranged for simplified radio construction. The soldering is already done and the novice only has to complete the mechanical assembly.

Decorative Tuning Control

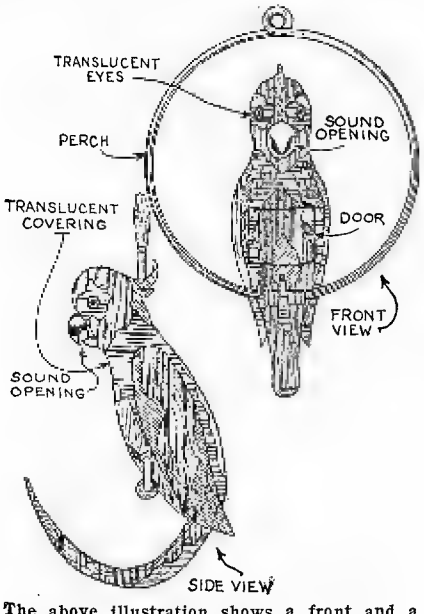
MR. L. A. BRAMS, an ardent radio fan, has utilized an ingenious method for tuning which greatly adds to the appearance of the receiver, a photograph of which is shown here. Two racing cars and a track are painted in oil upon the front panel. Each dial is then arranged to act as an indicator of the speed of the car. The cars are fitted with rubber-tired wheels which are used as the tuning controls. These extend about one-half inch beyond the front panel. As there are only three controls, one car is shown passing the other so that one of the wheels is hidden. For four controls, the two cars can be separated and with two controls one car alone should be used.



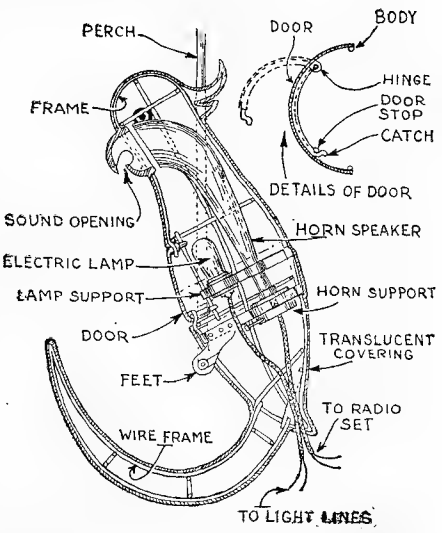
Above is a photograph showing the novel tuning arrangement. The tuning dials represent speedometers and the wheels of the racing cars are used as the tuning controls. The race track passes off in the distance.

Making a Parrot Speaker

A PATENT has recently been granted to J. A. Glassman on a most novel loud speaker which is ornamental as well as useful. This is made to simulate the appearance of a bird, such as a parrot, and thus gives the impression of a musical or talking parrot. A reproducing unit and horn are concealed within the body of the bird, the construction of which may be seen in the accompanying illustrations. The imitation talking parrot is firmly mounted upon a perch and the frame or body of the bird is constructed of heavy wire, either soldered or spot welded. If the bird is not rigidly fastened to the perch, the tail should be weighted, to act as a counter balance for maintaining the bird in an upright position. The cover and frame are shaped to provide an opening, from which extends a bill or beak, thus forming a means for allowing the sound to escape. The horn and unit are positioned as shown, so that the mouth of the horn is adjacent to the sound escape opening. The frame of the bird should preferably be covered with some translucent material, so that a small electric lamp can be placed within the body, adding greatly to the appearance of the speaker. The cover should be colored after the manner of the color of a parrot, so as to produce a pleasing and ornamental effect. The frame of the bird in the front is also provided with a door opening, details of which are shown. This allows the insertion or removal of the electric light lamp and also makes it possible to properly adjust the speaker unit. Two cables, one from the speaker unit and one from the lamp, pass through a small opening from the bottom of the bird. These lead respectively to the radio set and light lines.



The above illustration shows a front and a side view of the finished loud speaker.



A sectional view of the parrot speaker is shown in the above illustration. Details of the door are also given.

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RADIO ORACLE

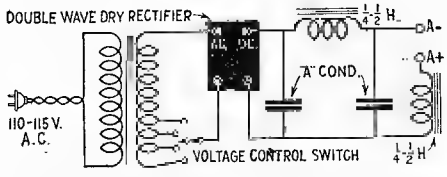
In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

"A" ELIMINATOR

(643) R. F. Beck, Pittsburgh, Pa., asks:

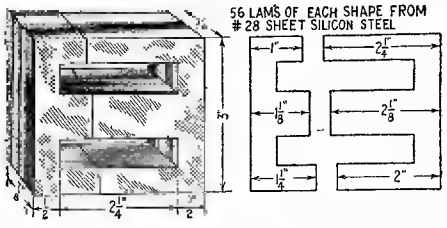
Q. 1. Will you please publish in the Oracle the necessary information for the construction of an "A" eliminator supplying power for five 201A tubes. The secondary voltage should be between 8 and 10½ volts.

A. 1. You will find illustrated on this page



The circuit diagram of the "A" eliminator using a double-wave dry rectifier is shown above. Two "A" condensers and two ½ to ¼ henry chokes are used for the filter.

the circuit diagram of the eliminator and the data for the step-down transformer. The design of the choke coils will be found in the Radio Oracle department of the April, 1928, issue of this magazine. The shape of the laminations and the method of assembly of the transformer core are clearly shown in the illustration. Fifty-six laminations of each shape are required and are cut from sheet silicon steel of No. 28 U.S.S. gauge. The primary winding consists of 616 turns of No. 23 enameled wire and the secondary of 64 turns of No. 16 enameled wire, tapped at the following turns: 48, 50, 52, 56, 60 and 64. Taps should be made by soldering insulated flexible wire to the various points on the secondary coil, in order to avoid the nuisance of broken connections within the coil. In assembling the core, the laminations should be so placed that the butt joints of each pair of laminations do not lie directly above one another. For this reason laminations are made in two different shapes. Two one-half henry or one-quarter henry choke coils and two .1 farad condensers are used for the filter of the rectifier output. A voltmeter placed across the A— and A+ terminals should read about 6 volts under load conditions. The voltage control switch should be adjusted until a suitable reading is obtained upon the filament voltmeter.



Details of the transformer laminations and the method of assembly are given in the above illustration. The laminations are made from No. 28 gauge sheet silicon steel.

CAPACITY SHUNTS

(644) J. B. Taylor, Port Jervis, N. Y., asks:

Q. 1. Why are fixed condensers sometimes used across the primaries and secondaries of audio frequency transformers.

A. 1. By using by-pass condensers across transformer primaries or secondaries, the response to high frequencies will be noticeably lessened. Increasing the capacity increases the cut-off of these higher frequencies. With poor audio transformers or with resistance or impedance coupled amplifiers, where it is desired to reduce the cut-off frequency in order to eliminate the rushing or hissing sound, by-pass condensers may be employed advantageously. The value of such a condenser ranges from .0001 to .001 microfarads if connected across the secondary of the audio frequency transformer. Condensers from .001 to .01 microfarads across the audio frequency transformer primary will serve the same purpose. Condensers have a capacity of .01 to .1 microfarads, if placed across the loud speaker will have a similar effect and will cut off the higher frequencies and seemingly accentuate the lower ones. Condensers and resistances operate additionally as loads on the amplifying stages and will serve to stabilize the audio amplifier.

ADDING REGENERATION TO THE SUPER-HETERODYNE

(645) H. Lamb, Brooklyn, N. Y., asks:

Q. 1. Can I add regeneration to my super-heterodyne receiver which uses a loop antenna?

A. 1. A super-heterodyne designed to be operated on a loop may be changed so that regeneration is obtained. This loop regeneration takes place in the circuit of the first detector or frequency changer tube and has no effect on the intermediate amplifier. It is usually possible to obtain regeneration in the intermediate amplifier by bringing the grid returns to a potentiometer connected across the "A" battery. An intermediate frequency amplifier of this sort will be more effective when used at a rather high intermediate frequency and with air core transformers. Regeneration may be applied to the second detector circuit when using an air-core filter transformer. Since the amount of energy collected by a loop antenna is comparatively small even under the most favorable conditions, it is of great advantage to employ regeneration. This will greatly reduce the effective resistance of the loop circuit at the particular frequency being received. Regeneration may be obtained in a loop by any of the methods which allow regeneration in a tuned radio frequency transformer. Energy from the plate circuit of the first tube may be fed back into the loop through a variable condenser of small capacity. One end of the loop is connected to the grid of the first tube, and about two turns away from the filament end of the loop a tap is taken and from this tap a connection is made to one side of a small variable condenser and from the other side of this condenser, a connection is made to the plate of the first tube. Another method consists in winding a few turns of insulated wire around the loop and using this as the tickler winding. Regeneration may be controlled by a variable high resistance or a variable condenser.

BROADCASTING STUDIO ACOUSTICS

(646) J. Geddes, Marion, O., asks:

Q. 1. Can you give me any information concerning experiments which are now being made with multi-layered walls used in radio broadcasting studios?

A. 1. According to recent experiments by Dr. E. C. Wente, and E. H. Bedell, of the Bell Telephone Laboratories, described in *Science*, multi-layered walls are the most efficient absorbers of deep musical sounds. In radio studios where echoes are troublesome and must be carefully controlled, better acoustic properties can be obtained through the use of a thin perforated partition set a short distance from the main wall.

Formerly such sound studies had to be made in a large room, with good-sized pieces of the material to be tested. Dr. Wente and his associate have invented a way of testing in a small tube, and they claim that it gives results as satisfactory as with the older method. At one end is a telephone receiver to furnish the sound of any desired pitch. Sliding in the other end is a piston, with which the material undergoing test is covered. The echoes formed are studied with a still smaller tube that goes into the main tube at the end near the telephone receiver. On the outside, at the end of this small tube, is a telephone transmitter with which the sounds can be picked up and analyzed.

Sounds of high pitch are largely absorbed by layers of felt, porous "acoustic tile" or wood fiber mixed with felt. Deep or low frequency sounds pass through rather easily. But if the wall is covered with felt, and then, an inch away, a piece of perforated building board is placed, the low frequency sounds are much more completely absorbed. Still better is the effect of two layers of building board, with two air spaces.

Somewhat similar to this is the method recently adopted by engineers of the National Broadcasting Company in designing the new studios of station WRC in Washington. In order to make a sound-proof window between the studio and the control room, three layers of glass of different thicknesses are used. Each piece has its natural frequency and sounds of a similar pitch would be transmitted. But sounds that get through the first layer are stopped by the second, while any that might still leak through are stopped by the third.

DIRECTION FINDER

(647) M. Howe, Bronx, New York, writes:

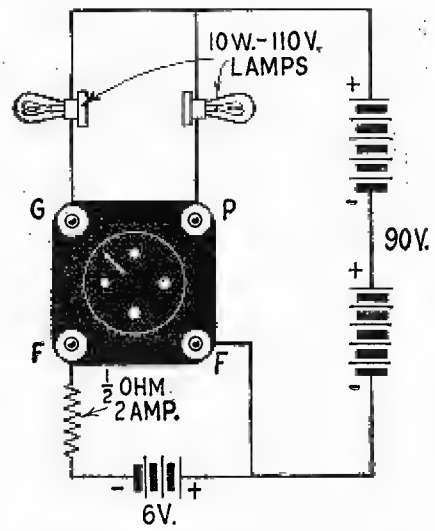
Q. 1. Can you tell me something about the accuracy now made possible with the latest direction-finding equipment.

A. 1. The guarantee limit of accuracy of a direction-finding station is usually about one degree for a shore station and about two degrees when used on a ship. Greater accuracy can be procured on a shore station over large sectors of the arc over which the station operates, but there are usually a few residual errors and an accuracy of one degree is all that is normally required. It is difficult to obtain as high a degree of accuracy in a ship direction-finding station, but the same accuracy is not required at sea. The function of a station of this nature in a ship is primarily to establish a check on the other methods of navigation and to provide the navigator with relative bearings by means of which he is often able to find his position. It is possible to make a direction-finding station which, by careful attention to detail and thorough shielding, will have a directive effect so accurate that variations of a quarter of a degree can be detected, but this is no proof of the accuracy of the instrument as a direction-finder. The accuracy depends upon a large number of other factors in addition to the quality of the apparatus used.

POWER TUBE TESTER

(648) J. H. Morales, Wichita, Kansas, writes:

Q. 1. Kindly publish a circuit of a tube tester suitable for use with rectifiers of the thermionic type and for 210 power tubes. A simple inexpesive tester is desired which uses no meters, if such is possible.



TYPE	IND. FOR GOOD TUBE
210	NO.1 DULL RED NO.2 DULL ORANGE
213	NO.1 DULL ORANGE NO.2 " "
216 B	NO.1 DARK NO.2 DULL ORANGE
280	NO.1 DULL ORANGE NO.2 " "
281	NO.1 DARK NO.2 DULL ORANGE

The circuit diagram for the power tube tester and a table showing the indication for a good tube appear above.

A. 1. On this page you will find an illustration of a tube tester which we believe will meet with your requirements. Two 10 watt 110 volt lamps are used as indicators. When testing a 210 power tube, No. 1 should burn a dull red and No. 2 dull orange. With the 213 tube, both lamps should light to a dull orange color. When testing a 216 B, No. 1 should be dark and No. 2 dull orange, with a 280, No.'s 1 and 2 should be dull orange, and with a 281, No. 1 should be dark and No. 2 dull orange.

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Scientific Humor

FOR THE NEXT BATTLE-GEESE

"Have you got a telescope that will enable me to see Betelgeuse?"

"Have we? We've got a telescope so strong that you can tell two fighters apart from a $5.00 seat."—*Gleason Pease.*

LUCKY BOOKKEEPER

NEWLYWED: "Honey, I don't like this cooking."

HER: "But, dear, that is scientific cooking."

HIM: "Well, just remember you're cooking for a bookkeeper not for a scientist!"—*Henry. A. Courtney.*

WHAT A SIGHT

HOST: "Now here's the bathroom."

GUEST: "And, 'er, have you installed a television arrester?"—*Gleason Pease.*

TELEVISION

SHE: "No, George, you can't see me tonight. There's a lot of static and I look a perfect fright."—*Gleason Pease.*

A CRANKY CRANK

SON: "Where's the automobile crank?"

MOTHER: "He's gone to get some gas, my dear."—*Ernest B. Smith.*

ACHE-LESS AGE

"A British scientist predicts that, in time to come, men will be born toothless. I thought, in my ignorance, that they usually were born that way."—*Francis Demarest.*

OVERBOARD TO SAVE TIME

TIMID YOUNG THING: "What sort of food do you advise me to eat for the first few days of the voyage?"

BRUTAL STEWARD: "Milk, it doesn't scratch when it comes back up."—*Everett W. Boward, Jr.*

ONLY NEED REMOVE ONE—ONE LEFT

HE: "This plane is equipped with two Wright Whirlwind motors."

SHE: "Why didn't they make one of them a left?"—*Gleason Pease.*

FIRST PRIZE $3.00

SAME OLD WAY

A young salesman was seen to turn away from a prospective buyer of an electric washing machine, with a disgusted look on his face. The "boss" immediately wanted to know why.

"She doesn't want an electric washing machine," the young man replied. "I turned on the current and showed her how it worked, and finally she pointed to the hole in the bottom and asked":

"What is that for?"

"To let the water out," I said.

"Oh, then it doesn't wash by electricity; you have to use water."

THE VOID

SWIMMING TEACHER: "Now don't forget: A hollow body can't sink. Next lesson I'll show you how easy it is to keep your head above water!"—*Clifton Ask.*

ALL jokes published here are paid for at a rate of $1.00 *each;* $3.00 *is paid for the best joke submitted each month.*

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

Unavailable material cannot be returned.

WEATHER OR NOT

HE: "That new barometer I bought is the bunk."

FRIEND: "Why is that?"

HE: "I set the hands at 'Fair Weather' and it rained all day long."—*Edward Foale.*

USING THE BEST

"Madam," said the doctor, "I shall have to paint your husband's throat with nitrate of silver."

"Please use nitrate of gold, doctor?" exclaimed Mrs. Moneybags. "The expense is quite immaterial."—*Elsie Koester.*

CONCRETE EVIDENCE

The teacher was explaining to the class the properties of matter. He told the class that matter decreases in weight as the altitude increases, and that matter increases in weight as the altitude decreases.

He then asked the class to give an example of this. A wise student stood up and said, "Once I fell off a high scaffold. When I reached the pavement below, I felt so heavy that I could barely get up and walk away."—*Harry Gallay.*

MONEY VS. FLESH

A salesman for a certain flesh-reducing company that was going bankrupt, went to England with several bottles of his company's product.

He gave a respectable lady the bottles as a gift and prescribed a too large dose. As a result doctors were kept busy. When he called, she exclaimed:

"You've cost me 15 pounds already."

He returned to America and had these advertisements printed:

"English lady loses 15 pounds in short time."—*Rubin Breidbord.*

ALL LOOK ALIKE

TOURIST: "What have you got in the shape of automobile tires?"

SALESMAN: Cone loud speakers, funeral wreaths, life preservers and doughnuts."—*Paul K. Chapple.*

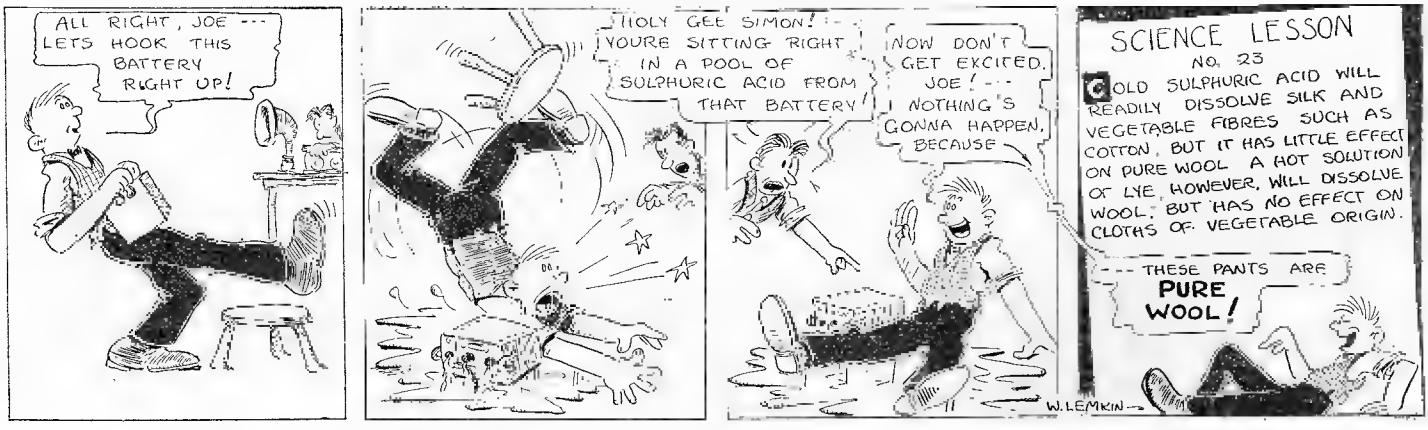
QUITE CORRECT

FIRST ELECTRICIAN: "You put me in mind of George Washington."

SECOND ELECTRICIAN: "That's funny, he wasn't an electrical expert!"

FIRST ELECTRICIAN: "That's it; neither are you."—*Frank Mannen.*

SCIENTY SIMON, Scientist


ALL RIGHT, JOE --- LETS HOOK THIS BATTERY RIGHT UP!
HOLY GEE SIMON! YOURE SITTING RIGHT IN A POOL OF SULPHURIC ACID FROM THAT BATTERY!
NOW DON'T GET EXCITED, JOE! --- NOTHING'S GONNA HAPPEN, BECAUSE
SCIENCE LESSON
NO. 23
COLD SULPHURIC ACID WILL READILY DISSOLVE SILK AND VEGETABLE FIBRES SUCH AS COTTON, BUT IT HAS LITTLE EFFECT ON PURE WOOL. A HOT SOLUTION OF LYE, HOWEVER, WILL DISSOLVE WOOL, BUT HAS NO EFFECT ON CLOTHS OF VEGETABLE ORIGIN.
--- THESE PANTS ARE PURE WOOL!
W. LEMKIN

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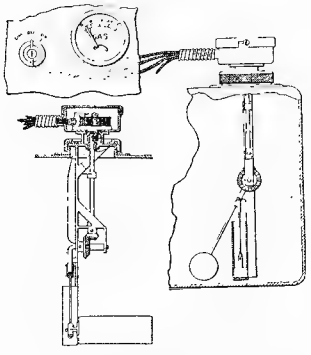
Latest Patents

ELECTRIC LIQUID LEVEL INDICATOR

No. 1,676,255, issued to Alphons, Emil,and Nicholas Dittlinger. The vertical movements of a float are utilized to rotate a sliding contact on an electric potentiometer. A milliammeter indicates the liquid level.

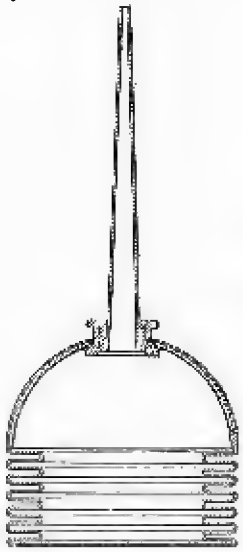


COMBINED GAME AND FINGER RING

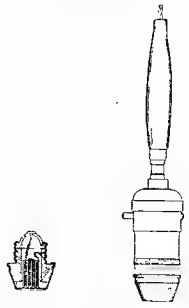
No. 1,672,355, issued to Joseph B. Ullman. The ring is provided with a jewel recess and with one or more disks whose edges are marked with characters similar to the spots on dice faces.

COPIOUS FLOW OIL CAN

No. 1,668,895 issued to Weston M. Fulton. The illustration below discloses the operating principle of this container, which may of course be used for other liquids beside oil. The construction is such that a measured quantity of liquid may be ejected by simply pushing the bottom until the motion is limited by an adjustable stop.

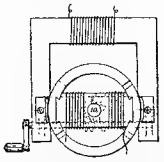


ELECTRIC CIGARETTE LIGHTER



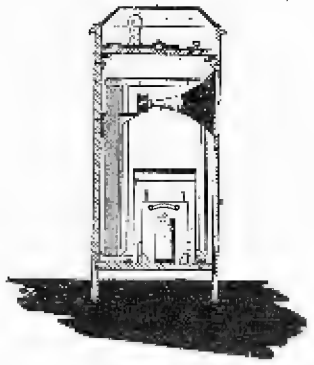
No. 1,653,751 issued to Stephan Wagner. This lighter operates directly from the light socket. The heating element contained in a soap stone insulator heats a small disk of mica to a red heat. The construction of the unit is such that repairs may be made with ease.

ALTERNATING CURRENT REGULATOR



No. 1,671,963 issued to David L. Alexander. The variable action is obtained by using a transformer with specially constructed leg, which is rotatable as shown. When the movable leg is rotated from the position shown here, part of the flux is shunted around the straight portion of the core, thereby reducing the amount of flux moving through the secondary winding.

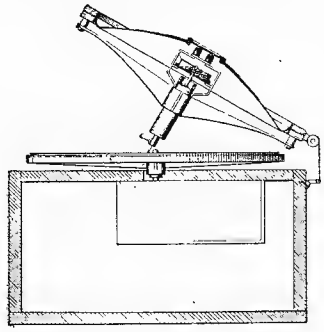
RADIO RECEIVING SET



No. 1,664,548 issued to David Grimes. The set is particularly designed to be used by unskillful operators. Another feature is the use of an unusual loop antenna, which eliminates the necessity for any external wiring or apparatus. The receiver uses either two loop antennas at right angles to each other, or a special loop which is responsive to radiant electrical energy from any direction, which loop takes up practically no cabinet space.

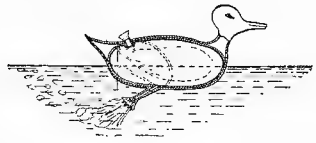
ELECTRIC PHONOGRAPH

No. 1,671,509 issued to George B. Burch. The turntable is rotated by an electric motor. The needle vibrates a conoidal radiator and at the same time actuates a microphone. The microphone current energizes the coils of a speaker unit driving above mentioned cone.



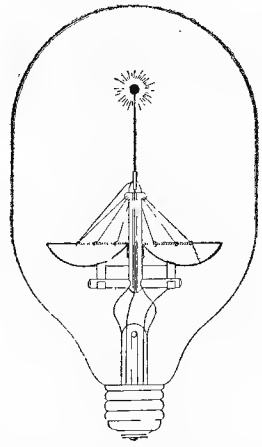
INFLATABLE WATER TOY

No. 1,673,479 issued to Lewis H. Allen. The toy contains a rubber balloon which is inflated to provide motive power for propelling the toy on water. The drawing shows the simplicity of construction

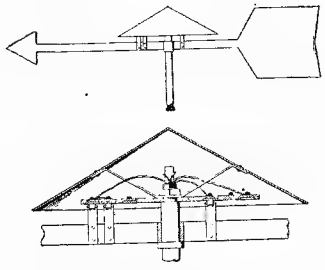


ELECTRIC INCANDESCENT LAMP

No. 1,676,300 issued to Alexander Sved. The claim for superiority to the usual lamp is based on the fact that this lamp converts to light, part of the heat radiated from its white hot filaments. This is accomplished by focusing these rays of radiant energy on a small sphere of some material such as thoria with 1 per cent ceria.

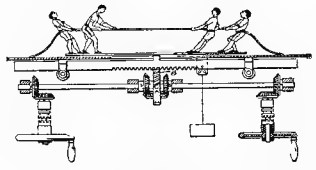


ELECTRIC WEATHER VANE



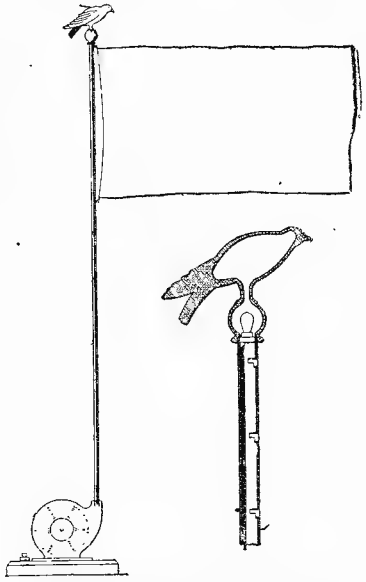
No. 1,670,488 issued to Hiram B. Whitcomb. With this device installed in a building the direction of the wind can be ascertained without viewing a weathervane, the direction being indicated by a small electric lamp on a dial inscribed with the points of the compass.

GAME APPARATUS



No. 1,676,755 issued to Alfred L. Walton. A model of two "tug-of-war" teams is arranged in conjunction with a coin operated mechanism in such a way that two people may compete to move the rope in their direction.

FLAG FLYING DEVICE



The invention provides for flying a flag without wind, by means of an artificial draft, and also provides illumination for the flag at night. C. A. Lapworth: No. 1,660,341.

NOTICE TO READERS: The above illustrated and described devices have recently been issued patent protection, but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available. and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information, as it is practically impossible to obtain up-to-date addresses. —EDITOR.

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The Oracle

The "Oracle" is for the benefit of our scientific student readers. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculation, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

STRIPPING SOLUTION

(2273) W. M. Nash, Gulfport, Miss., asks:

Q. 1. How may electroplated copper and nickel be removed from the objects upon which they have been deposited?

A. 1. Electroplated copper and nickel may be removed from articles by either one of two methods. The acid dip method for removing copper uses the following solution: A mixture of sulphuric and nitric acid in a 6 to 1 ratio. The article is dipped into this stripping solution until all the copper has been removed and then is rinsed in hot water. The stripping solution for nickel consists of the following: One part by volume of water, sodium nitrate and sulphuric acid. Nitric acid can be substituted instead of the sodium nitrate, and should be in a proportion equal to one-quarter of that of the sulphuric acid. The electrical method of removing plated metals, consists in using the articles as the anode, by reversing the direction of the current.

SCIENTIFIC SCALE

(2274) B. T. Bernand, London, England, writes:

Q. 1. Several years ago in one of your magazines you published what may be termed a scientific scale which showed various temperatures, melting and boiling points of a number of substances both in the Centigrade and Fahrenheit scales. If possible, I would like to see this republished in the Oracle.

A. 1. The thermometer scale you mention will be found on this page. The temperature ranges are from 3,500 degrees to minus 273 degrees Centigrade. No explanation is needed, as the scale is self explanatory.

SENSITIVITY TO SUNBURN

(2275) A. H. Prichard South Hampton, L. I., writes:

Q. 1. Is there any means by which an individual's sensitivity to sunburn can be measured?

A. 1. Whether or not you sunburn easily may now be tested in a doctor's office, without going to the seashore. At the meeting of the American Physical Society in Claremont, Calif., on June 15, Dr. Robert C. Burt, of Pasadena, told of a new instrument that he has invented and calls the "erythemameter." It measures sensitivity of a person to erythema, as the physician terms painful sunburn.

Erythema, or sunburn, is caused by the ultra-violet rays in the sun's light. It can also be caused by ultra-violet light from a quartz tube mercury vapor lamp, or one of the other forms of lamp now being used in the treatment of rickets and other diseases. In Dr. Burt's instrument such a quartz lamp is contained in a light-tight box from which the ultra-violet rays can escape through a hole about two inches square. This opening is placed directly against the bare skin of the person being tested.

A set of filters in back of this hole cuts off more and more of the rays in graduation across the opening, so that the skin at one edge gets the full benefit of the rays from the lamp, while that at the opposite edge receives none. After being exposed to this apparatus for ten minutes, the untanned skin of anyone becomes burned at the side receiving the most rays. The distance that the "sunburned" area spreads measures the person's sensitivity.

As it is also desirable to measure the effect of varying exposures on sunburning, a shutter is provided behind the opening also. This moves across the hole in a direction at right angles to that at which the intensity varies. When the exposure is complete it has moved completely across. The result is an actual curve drawn on the subject's skin which shows how long an exposure he can stand to ultra-violet rays of any intensity.

The instrument is expected to be useful to physicians who are now using ultra-violet rays in the treatment of disease. Over exposure of a sensitive person to them may be very harmful, and by making a test with such an instrument, injurious effects can be prevented.

Dr. Burt also described another instrument of his invention that measures intensity of ultra-violet light, either from the sun or an artificial source. It makes use of a photoelectric cell made of quartz, instead of glass, which latter is opaque to the rays which quartz transmits.

"The instrument is so portable and easy to use," says Dr. Burt, "that the day may come when up-to-date bathing beaches will have an observatory giving out the intensity of the sunburn light in the sun, so that each person may stay out just long enough to become a delicate brown, without becoming severely burned."

PERMALLOY

(2276) A. L. Stoddard, Roma, Texas, writes:

A. 1. Please give me some information about permalloy, that is, to just what alloys this name is applied, and also something of its permeability.

A. 1. Permalloy is the trade name for a series of nickel-iron alloys of extraordinary importance in the art of electrical communication, discovered and developed in Bell Telephone Laboratories. The first invention of permalloy was made some years ago by Gustaf W. Elmen, who for years has been engaged in investigating magnetic materials.

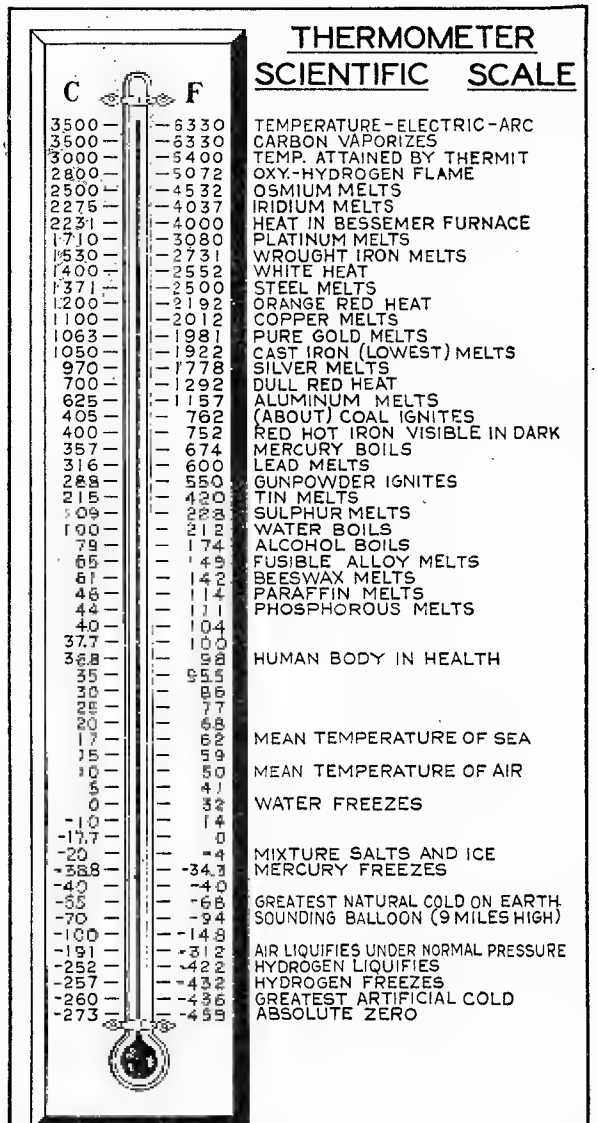
The name permalloy is applied to certain nickel-iron alloys which, when properly heat-treated, possess remarkable magnetic qualities. These properties are developed in alloys which contain more than thirty percent of nickel and the atoms of which have the face-centered cubic arrangement characteristic of nickel rather than the body-centered crystal structure characteristic of iron. While alloys throughout the entire range above thirty percent nickel exhibit these properties to some degree, the most remarkable magnetic effects are obtained with alloys containing nickel and iron in the proportion of eighty percent nickel and twenty percent iron. In the manufacture of permalloy it is desirable to use the purest commercial nickel and iron; and the heat treatment is of the utmost importance. To develop its highest permeability it must be cooled not only through the proper temperature ranges, but also at the proper rates; and each size and shape of finished product has its own best treatment.

To understand the magnetic properties of permalloy one need only to remember that permeability is the factor by which the magnitude of the cause, namely the field, must be multiplied in order to obtain the effect, namely the induction. Permeability, however, is not a constant factor independent of the magnetic condition of a ferromagnetic substance. It is in its initial permeability and its ease of magnetization under very feeble magnetic fields that permalloy is most remarkable. So sensitive may it be made, that it will be saturated magnetically in the earth's magnetic field. After being magnetically saturated, further increase of the field cannot, of course, produce large increases in magnetic induction; the permeability rapidly decreases and soon becomes less than that of Armco iron.

In electrical communication relatively intense magnetic effects are frequently desired to be produced by the very feeble currents used for signalling or for the transmission of speech. The discovery and development of permalloy, therefore, promises great assistance to the art of communication because of its ease of magnetization by the magnetic fields produced by feeble currents.

The name "permalloy" covers certain alloys of nickel and iron possessing remarkable magnetic properties. Several of these have been standardized and each is designated by the amount of nickel which is contained in it. The "45-permalloy" has a resistivity nearly as high as silicon steel, and a permeability four or five times greater, at low or moderately high flux densities. Its coercive force is also considerably lower.

The "78-permalloy," which has very remarkable properties, is used in the form of thin tape for loading high-speed submarine cables and in sensitive relays. Its permeability at low and at moderate flux densities is about twenty times that of silicon steel. Its coercive force is about one-tenth and its resistivity one-third less.


THERMOMETER
SCIENTIFIC SCALE
C
F
3500 — — 6330 TEMPERATURE-ELECTRIC-ARC
3500 — — 6330 CARBON VAPORIZES
3000 — — 5400 TEMP. ATTAINED BY THERMIT
2800 — — 5072 OXY.-HYDROGEN FLAME
2500 — — 4532 OSMIUM MELTS
2275 — — 4037 IRIDIUM MELTS
2231 — — 4000 HEAT IN BESSEMER FURNACE
1710 — — 3080 PLATINUM MELTS
1530 — — 2731 WROUGHT IRON MELTS
1400 — — 2552 WHITE HEAT
1371 — — 2500 STEEL MELTS
1200 — — 2192 ORANGE RED HEAT
1100 — — 2012 COPPER MELTS
1063 — — 1981 PURE GOLD MELTS
1050 — — 1922 CAST IRON (LOWEST) MELTS
970 — — 1778 SILVER MELTS
700 — — 1292 DULL RED HEAT
625 — — 1157 ALUMINUM MELTS
405 — — 762 (ABOUT) COAL IGNITES
400 — — 752 RED HOT IRON VISIBLE IN DARK
357 — — 674 MERCURY BOILS
316 — — 600 LEAD MELTS
288 — — 550 GUNPOWDER IGNITES
215 — — 420 TIN MELTS
109 — — 228 SULPHUR MELTS
100 — — 212 WATER BOILS
79 — — 174 ALCOHOL BOILS
65 — — 149 FUSIBLE ALLOY MELTS
61 — — 142 BEESWAX MELTS
46 — — 114 PARAFFIN MELTS
44 — — 111 PHOSPHOROUS MELTS
40 — — 104
37.7 — — 100
36.8 — — 98 HUMAN BODY IN HEALTH
35 — — 955
30 — — 86
25 — — 77
20 — — 68
17 — — 62 MEAN TEMPERATURE OF SEA
15 — — 59
10 — — 50 MEAN TEMPERATURE OF AIR
5 — — 41
0 — — 32 WATER FREEZES
-10 — — 14
-17.7 — — 0
-20 — — -4 MIXTURE SALTS AND ICE
-38.8 — — -34.3 MERCURY FREEZES
-40 — — -40
-55 — — -68 GREATEST NATURAL COLD ON EARTH
-70 — — -94 SOUNDING BALLOON (9 MILES HIGH)
-100 — — -148
-191 — — -312 AIR LIQUIFIES UNDER NORMAL PRESSURE
-252 — — -422 HYDROGEN LIQUIFIES
-257 — — -432 HYDROGEN FREEZES
-260 — — -436 GREATEST ARTIFICIAL COLD
-273 — — -459 ABSOLUTE ZERO

The scientific scale, in the form of a thermometer, appears above. Melting and boiling points have been indicated both in Centigrade and Fahrenheit scales.

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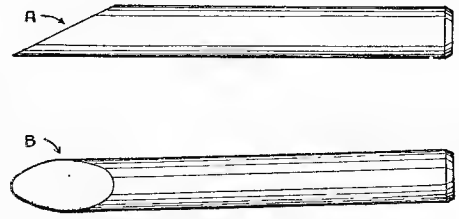
Hints for the Mechanic

Mechanics' needs have caused us to start this new department—"Hints for the Mechanic," in which we intend to publish wrinkles useful to mechanics in general. You can help us with this department by writing a brief description of your favorite shop wrinkle and sending this to the editor of this department, together with a pencil or pen and ink sketch of the wrinkle. The ideas published herewith will give you some idea of what we want. Our draughtsmen will make the necessary mechanical drawings, so you need not send us finished drawings. We will pay $10.00 each month for the best Wrinkle or Hint sent in; others published will be paid for at space rates. Address all letters to Editor, Hints for the Mechanic Department, in care of this magazine.

FIRST PRIZE $10.00

SUBSTITUTE REAMERS



Satisfactory substitutes for reamers can be made from a length of drill-rod cut at an angle, as shown at A. This makes a cutting edge, as shown at B. Use a reamer of this kind about 1/64 to 1/32 inch larger than the hole to be reamed.—C. A. Martin.

VISE HINT

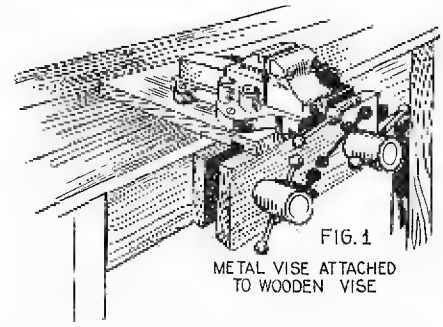
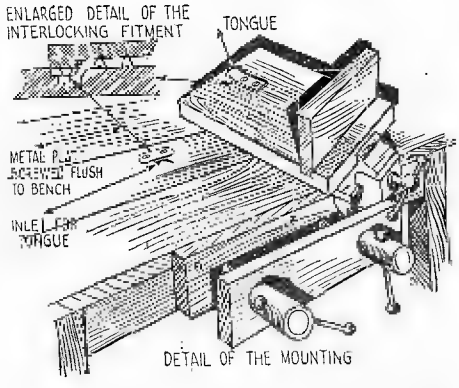


FIG. 1
METAL VISE ATTACHED TO WOODEN VISE

It frequently happens that the need for a metal vise arises and in order to conserve space it can be mounted on a wooden vise, as shown above in Fig. 1. The metal vise is first mounted on a piece of board. The screws which hold the vise to this board also pass through a board at right angles to the mounting board. The former is clamped between the wood vise, as shown.


ENLARGED DETAIL OF THE INTERLOCKING FITMENT
TONGUE
METAL PLATE SCREWED FLUSH TO BENCH
INLET FOR TONGUE
DETAIL OF THE MOUNTING

A small metal plate is next made flush with the bench top, as shown above. A metal tongue is fastened to the vise board and fits into a hole in the metal plate.—J. E. Lovett.

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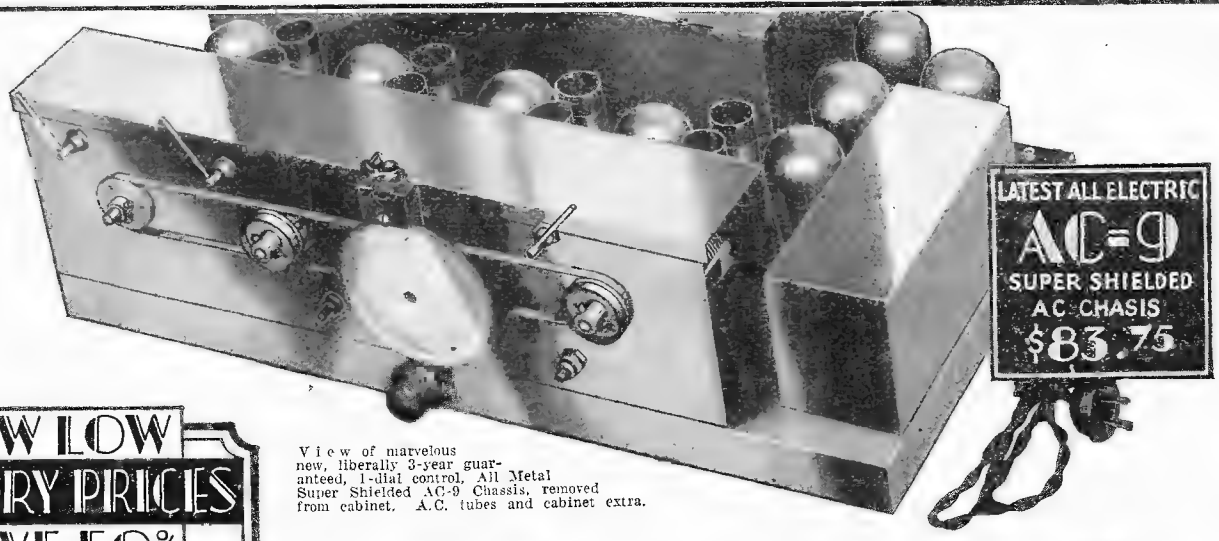

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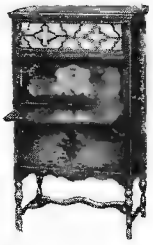

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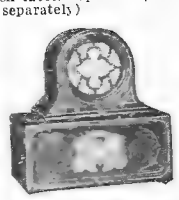

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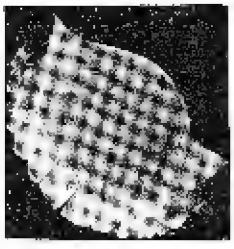

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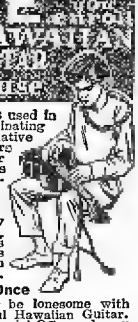

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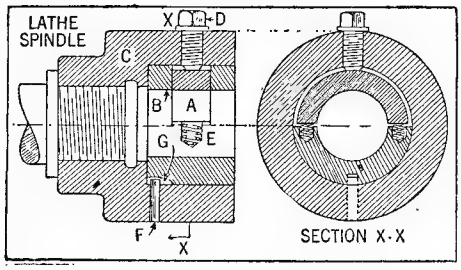

A lathe chuck for short round pieces of work can be made from cast iron fitted to the spindle of the lathe. A and B are the bushings, E coil springs, F pin, and G is a short keyway. Several size bushings can be made and used in a chuck of this kind.—F. N. Coakley.

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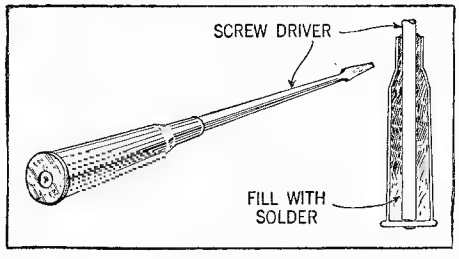

A simple and ornamental handle for small tools can be made from a brass cartridge. A wooden plug inserted in one end allows the shank of the tool to be inserted. Another way to hold the tool is to insert the shank and fill the opening with solder. The handle can be punched and polished if desired.—J. M. Brown.

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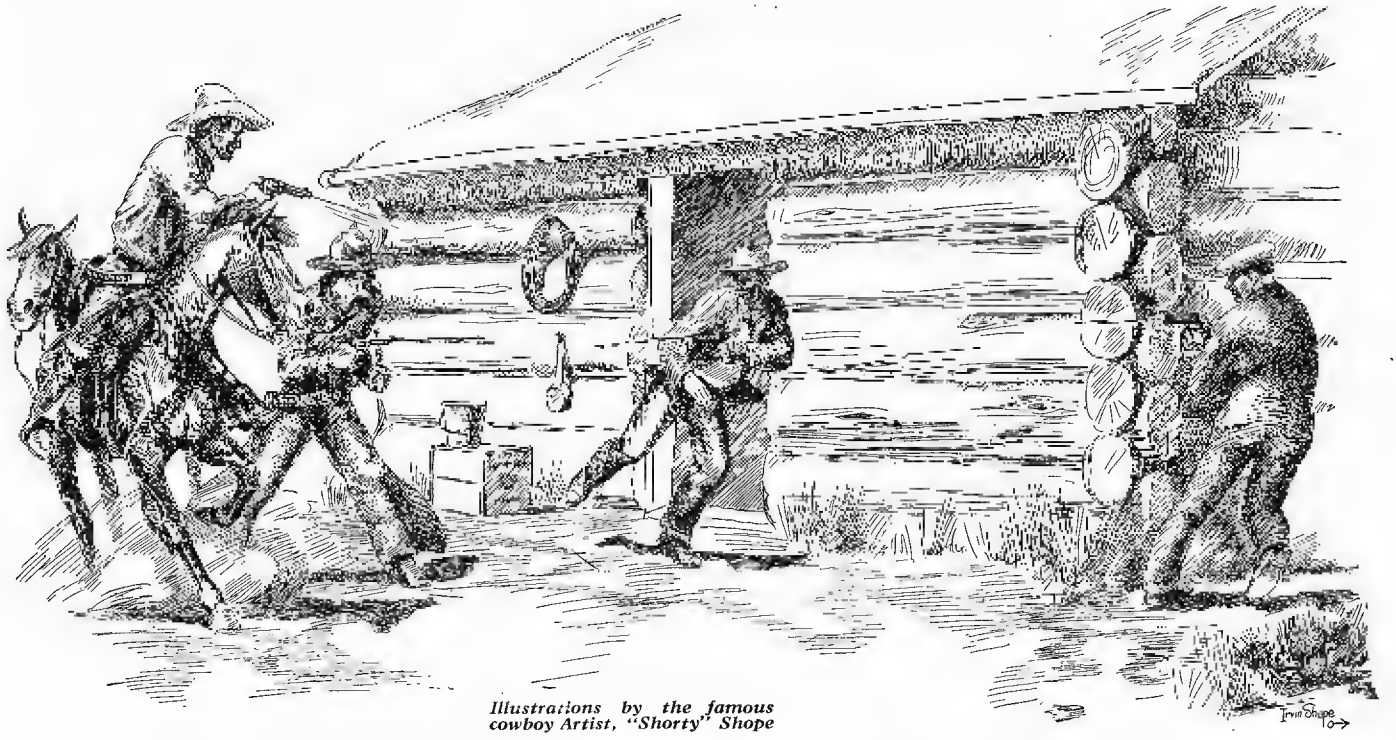

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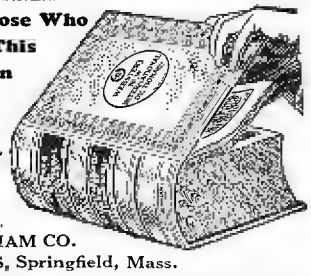

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Thermiting Icebergs

By HOWARD T. BARNES

(*Continued from page* 494)

been wonderfully successful. Previous to that, the Government built ice breaking piers along the shore, to cut the fields of ice as they were carried by the flood waters into the farm lands. Now the floods are eliminated and the value of the farms along the shore has gone up tremendously.

ICE-BREAKING STEAMERS—HOW BUILT

AN ice-breaking steamer should be built for power, and so as to be able to withstand the impact of solid ice several feet in thickness. The boats are many of them made to ride up on the ice and crush it down by the great weight of the bow portion of the boat. Many of the boats are provided with a propeller in the bow set low in the water, in order to suck the great cakes of ice broken by the crushing and cutting action of the bow down and pass them along under the ship to the stern.

An icebreaker should have twin propellers, so as to enable her to steer when the rudder is disabled or unable to move in the ice. The hull should bulge on the water line to give crushing power to the sides and the whole ship should sway from side to side to bring in the full benefit of the bulge.. No boat becomes stuck in the ice packs which has a perceptible oscillation from side to side.

Icebreakers should be provided with steam pipes or condenser water discharge in the bow. Many a ship has been stuck for hours in the solid ice packs which could have been immediately released by warm water or steam.

Much more progress has been made in Europe with ice-breaking ships than in America; but the bow propeller was invented by an American. This progress abroad has come from the greater need of opening the ports of Russia, Norway, Denmark, Sweden and Finland for commerce during the winter. When economical conditions demand, the way will be found for even greater ships and more powerful methods.

The largest ice-breaking ships are found in Russia. Here ships of 12,000 H.P. are used, which can operate through 6 feet of solid ice. Just what is meant by ice thickness is misleading. Solid ice can be broken by certain types of boats; while the great packs of dislodged and broken ice cemented by slush ice, which often attain a thickness of 90 feet if allowed to accumulate, will resist the largest boat. All efforts at ice work should be directed toward prevention, for it is by being prepared that serious accumulations can be avoided.

HIGH EXPLOSIVES AND HEAT

TO treat ice acccumulations in an emergency, such as a jam which causes serious and inconvenient floods, dynamite is often resorted to. It is very useful in many cases, and has saved many a serious situation. A slower explosion is more useful, however, such as that from blasting powder, but this is not so convenient or safe to use. In all use of high explosives, great caution must be taken to prevent carelessness, for much of this work is done under exceedingly trying conditions, often in great cold and high wind, and it is easy for accidents to occur then.

Heat is the natural enemy of ice, and in many forms it can be applied not only for preventative means but also to get rid of ice accumulations.

Steam heat and warm water is very effec-

(*Continued on page* 542)

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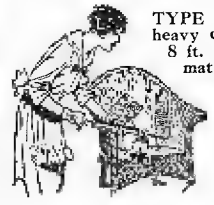

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Thermiting Icebergs

(Continued from page 540)

tive when continuously applied to water bearing ice. The ice is prevented from sticking to objects in the water, and it is to a great extent prevented from forming.

You must realize that the ice is present in the water often when unseen. These ice particles increase in number until the freezing point is reached when the water is a saturated solution of ice. To break up the ice molecules in water before it freezes, chemicals such as salt or calcium chloride can be used, but have to be used in too large quantities to be a practical means to prevent a river from freezing. When water freezes, the ice particles separate out as solid crystals and float in running water or accumulate on the surface in still water to form the surface sheet. We must realize how difficult it is to cope with ice formation when the only difference between liquid water and solid water is a small fraction of a degree of temperature like a thousandth part of a degree, so small as to escape detection on the most delicate thermometer. Nevertheless, this fact, which is of so much importance, has pointed to us a way to prevent ice and to loosen ice when it is formed. We have merely got to raise the temperature through a very minute temperature above the freezing point to loosen ice. The rays of the sun do this in the coldest weather.

To supply artificially enough heat to melt an iceberg or a jam is both physically and financially far beyond the range of feasibility. Skilful, limited applications of heat will, however, accomplish much.

One of my discoveries was that thermit could be used effectively at modest cost. Thermit is a mixture of finely powdered aluminum metal and oxide of iron. When properly ignited, thermit reacts vigorously, generating very high temperatures and producing extremely hot liquid steel. Many of my hearers have seen thermit in action in city streets, where rail joints of a trolley line were being welded, or in manufacturing plants.

The energy from this molten steel supplies rays that equal or surpass those of the sun in power to penetrate ice for many feet. The action of the white-hot steel upon the ice is remarkable, converting it into hydrogen and oxygen gases so rapidly that a powerful explosion results. Thermit itself is not explosive and can be handled safely. In addition to disruption by the explosion, the water currents are restored to their original channels and continue to wash away the ice weakened by the heat rays and explosion. In this way a huge jam may readily be broken up so that it will float piecemeal harmlessly down the river, or an iceberg be split into fragments so small as to be no menace to commerce.

In February, 1925, for the first time, an ice jam was treated by this radiant heat method. On that occasion, 250,000 tons of ice at Waddington, New York, in the St. Lawrence River, moved out in a few hours after the reaction of three thermit charges of ninety pounds each. A jam at Ogdensburg, New York, containing a million tons of ice, was removed in nine hours with two ninety-pound charges of thermit. A jam 8,500 square feet in area, nine feet thick, was lifted off a shoal at Morrisburg, Ontario, and broken up by one charge of ninety pounds. Similar operations have been successfully carried through, including the removal, without damage, in ten days, of a dry jam twenty-five miles long at Oil City and Franklin, Pennsylvania. The City of Belleville, Ontario, on the Moira River, was protected from a severe flood last winter by thermit and calcium chloride.

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In 1910, I sent out my first expedition to study icebergs. Others followed. In 1924, I observed that water from surface melting flowed all the daylight hours on an iceberg, maintaining a surface temperature at the freezing point. During the night, the water froze. The greatest cracking of the ice and breaking off of fragments occurred early in the morning and immediately after sunrise. These observations prompted the thought that strains could be set up at will in a great ice mass by local applications of heat at a high enough temperature to cast powerful rays into the ice.

The first tests were made in 1926. One berg treated was approximately five hundred feet square at water level, with cliffs rising on one side seventy-five to one hundred feet. A hole was bored into it about three feet and charged with one hundred pounds of thermit. When this charge was fired, flames shot upward one hundred and twenty-five feet and the explosion threw off great masses of ice. The intense heat in direct contact with the hard ice sent a temperature wave into the mass which caused a great deal of cracking and visible disruption. This cracking went on all evening. Toward morning there was a very loud report. Later in the day we found the great bulk of the interior had come away. The day following revealed the full effect of the cracking, for the whole plateau in which the charge had been placed split and broke away, almost across the thermit hole. Approximately a third of the ice was split off. Had we placed a few more charges, the whole berg would have been broken up. Sinking the charges deeper into the ice, as could easily be done, would have increased their effectiveness.

AERO-ICE

IN the remarkable development of aerial navigation, many new problems arise from day to day. The introduction of the air-mail, with the subsequent necessity for night-flying in all weathers, has shown that the formation of ice on the struts, wings and propellor of the aeroplane is a menace. It is generally acknowledged that very little is known of this phenomenon, and that the Pilot is often brought down by serious interference. From the result of an enquiry sent out to pilots all over Canada and the United States, it appears that the problem is a real one and deserving of the most careful study. Luckily, it is possible to interpret and explain most of the problems of aerial ice by the similitude of water borne ice. Thus hail, snow and fine ice sand of the atmosphere resemble the frazil and slush ice of our rivers. The frost and sleet resemble the anchor ice which is formed on the bottom of a swiftly flowing stream.

The surface of the aeroplane is cooled by virtue of its great speed through the air after it has had a small deposit of dew or thin ice on it, just as the wet bulb thermometer is cooled in the sling psychrometer.

The cooling of the surface is also effected by nocturnal or terrestrial radiation. This is a very rapid process at times when the air is very clear and may lower the surface of the place several degrees in as many minutes. When so cooled to a sufficient amount, the surfaces easily take up ice from a cloud or in a humid space. Thus it is possible, in an otherwise clear air, to have a rapid deposit of ice when the temperature of the air is a few degrees above or below the freezing point. Where the velocity is the highest, which is around the propellor blades, the ice appears to deposit very rapidly, just as anchor ice grows in water on objects over which the water currents are swiftest. This problem is receiving at the present time the attention of scientists, and a solution will doubtless be obtained by employing a covering material for the surface of the aeroplane, to which ice does not readily adhere.

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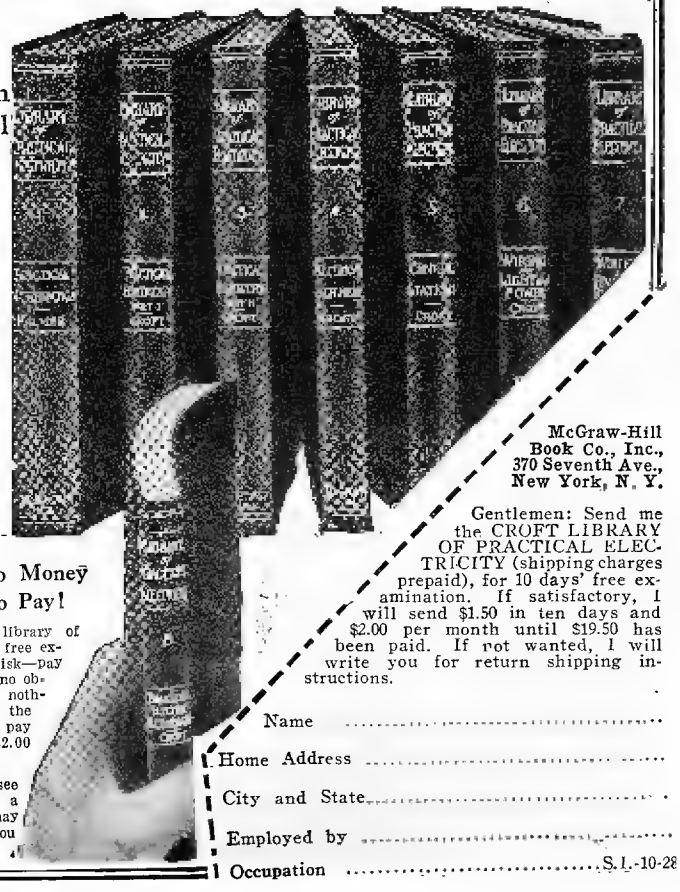

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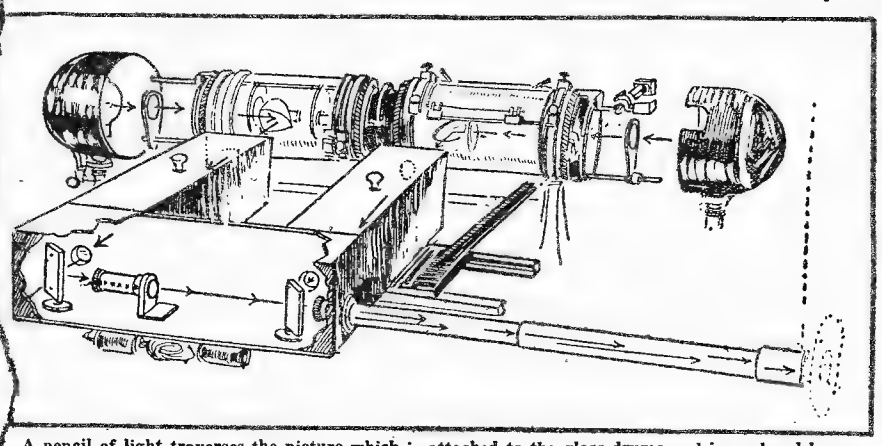
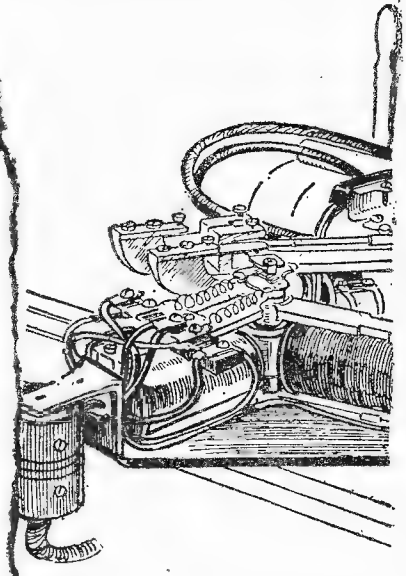
ransmission of Photo's by Radio

RANSMISSION OF PHOTOGRAPHS BY RADIO—Various methods have been devised and are now in use for the transmission of photographs by radio. Among these may be mentioned the systems of *Belin* (q.v.), *Baird*, and *Jenkins*. The principles underlying the Jenkins system are explained under the heading of *Television*. Using the system developed by Capt. R. H. Ranger, photographs were transmitted by radio from Honolulu to New York, a distance of 5,136 miles. Recently commercial picture transmission service has been inaugurated between New York and London using the Ranger apparatus. Two distinct methods have been applied for analyzing the picture in the process of transmission. One arrangement consists of producing an image as a non-conducting deposit upon a metal foil which is traversed by a stylus, while the other method makes use of an opaque image deposited upon a transparent film which is traversed by a beam of light, the light interruptions being recorded by a light sensitive cell. The Ranger system makes use of this latter method. The image is photographed [illegible] recorded upon a cell [illegible] to accom[illegible]



A pencil of light traverses the picture which is attached to the glass drums and is analyzed by a slow rotating action as well as a backwards and forwards movement of the carrier.

the electron flow constitutes a discharged circuit, so that the grid becomes less negative. The first amplifying tube is a direct current potential amplifier, and is resistance coupled. The grid and plate connections of the amplifier are connected across a condenser which becomes discharged with the fall in the grid to plate resistance of the valve brought about by the grid potential fluctuations. A charging circuit is connected to the condenser and is controlled by a valve, the grid circuit of which operates by variations of the potential across the condenser. The charging current is fed through the plate circuit of this valve, in which a relay is connected, which working through other mechanical relays in cascades, controls the radio transmitter. Wave trains from the transmitting station after detection and amplification, are applied to the picture recorder. The recording mechanism, in order that it may be sensitive to exceedingly small currents, comprises, a small moving coil, in a magnetic field created by three electromagnets. The coil of wire, in moving in the field, as the received fluctuations



recording mechanism of the receiver. Th which a moving co

applied through its windings, ates a stylus while travelling oss the surface of the paper. The us traverses the paper in perfect chrony with the carriage of the nsmitter, the paper being lifted

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FUTURE DEVELOPMENTS

FOR the future we may look for great development in ice preventive methods and new discoveries in the field. The great thing is to have courage and determination and not to be deterred by our natural dread of ice, which has come to us far down the ages as if it were an inheritance from the terrible stress of privation and suffering of the ice ages. We shall overcome to a great extent the loss from ice, but we must be prepared to meet the enemy when it strikes. We know fairly well when it is likely to do so, but never the exact moment of the onslaught.

Questions asked Prof. Barnes by Mr. Hugo Gernsback, Editor-in-Chief at conclusion of the lecture over WRNY:

Q. 1. It has often been noticed that lakes, or other still water bodies, have been cooled below freezing, yet did not freeze until a stone was thrown in the water; when immediately, the entire surface of the water froze over. Can you give us a simple explanation for this?

A. 1. When water is perfectly quiet and undisturbed the temperature may fall several degrees below the freezing point without *visible* ice forming. This means that the water, which is a solution of ice at all temperatures, becomes super-saturated with the dissolved ice when the temperature drops below 32° Fahr. The condition of instability thus created is relieved on the slightest agitation or on the introduction of a small crystal of ice. The manner of freezing represented by this question is illustrated by solutions of salt or sugar.

The reason for the freezing on the surface is that the surface of still water becomes cooled faster than the interior and from the position of the temperature of maximum density at 39° Fahr., the cooled layers have no tendency to sink down. Thus the surface may be supercooled, while the interior is still much above the freezing point.

Q. 2. I was much interested in your remarks concerning ice and airplanes. Has the use of paraffin oil on airplane wings been of much help to reduce ice?

A. 2. It is claimed in the Bremen flight that the paraffin oil used on the wings of the plane prevented ice formations. This has been suggested before but probably never given so good a test. Undoubtedly the paraffin will help to reduce the sticking or adhesion of ice in flight. There are other substances which will reduce this hazard but the question of the adhesion of ice to surfaces requires careful scientific investigation. Little or nothing is known about the physics of ice adhesion, but from tests which I made on water born ice adhering to various surfaces, I am convinced that there is a great difference which cannot be explained without more careful experiments under test conditions in flight.

Q. 3. Would a minute quantity of oil, forced about the center of the propeller, and just enough to keep a film of oil on the propeller tend to keep off ice?

A. 3. Yes, if the oil were heated, otherwise doubtful.

Q. 4. What, in your opinion, is the best means to keep ice from forming in the streets of our cities, or is it not possible to hope for such ice elimination, particularly in the northern cities?

A. 4. This is a very big question and one which is receiving more and more attention

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every year. The great advance in the past thirty years in winter operation of traffic is astonishing, but there is much more to be done in this direction. I believe it will not be many years when the snow and ice problems of our northern cities will be solved.

Q. 5. Has any plan been undertaken or proposed to free our shipping lanes from the iceberg danger by means of your thermit principle?

A. 5. Not until I have made it possible to place the thermit into an iceberg without having to go on the berg. This boarding an iceberg is hazardous and in many cases impossible. My experiments were made to demonstrate the physical fact that high temperature heat would crack the solid ice much as heat will crack a mass of hard glass. This was demonstrated in my experiments of 1926 at Twillingate, in Notre Dame Bay. Three icebergs were cracked and destroyed then by an insignificant amount of thermit. I am working on the practical side of the problem now and have about solved it. Soon I expect to have a means for throwing a container onto the berg, have it melt its way down to any desired depth, and then disrupt the ice by the sudden generation of the terrific heat of the chemical. This will be all entirely automatic.

Book Review

PSYCHOLOGICAL CARE OF INFANT AND CHILD, by Dr. John B. Watson, M.D. (author of "Behaviorism"). Stiff cloth covers. 5½" x 7½", 188 pages; indexed and illustrated with half tones. Published by W. W. Norton & Co., New York City. Price, $2.00.

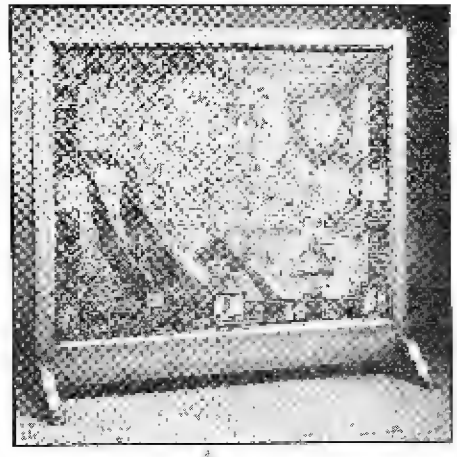
One of the most valuable popular books, which every mother and father can read and understand, is this latest work by Prof. Watson, who is well-known as the author of the now famous books on behaviorism. Dr. Watson has been criticized by many people, but in the opinion of the reviewer he has performed a fine piece of work in helping the parents of today to raise their children in the most logical, sane and healthy way.

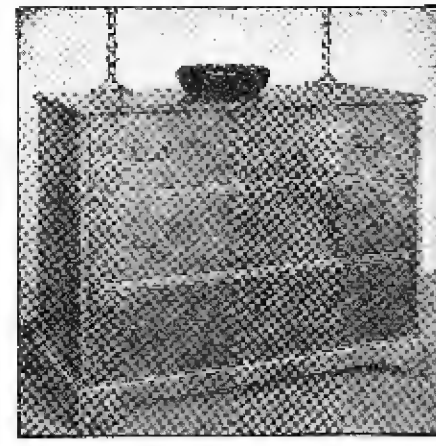
In this very useful and interesting illustrated handbook, the author explains how simple tests were made with many infants, in order to ascertain just what a young baby is afraid of. Some of the valuable advice given by the author relates to the fears of children and how to train them to forget these fears. Other sections deal with such important subjects as "too much mother love"; rage and temper tantrums; night and daytime care of infants; what shall I tell my child about sex, and when, etc. This matter of telling the growing child about sex matters is one of our most important national problems today; and every parent should without fail read the very sane and logical advice on this vital question as set forth by Prof. Watson. The reviewer feels, after reading this book, that the author is at least logical and that his arguments as set forth, have the element of common sense about them. There is nothing Freudian about them. If you have carefully observed and studied young children, you will get Dr. Watson's viewpoint quickly and agree with him, at least to a major extent, in the reviewer's opinion—H. W. S.

DYKE'S AIRCRAFT ENGINE INSTRUCTOR, by A. L. Dyke. Soft leather covers. 7" x 9½". 372 pages, illustrated. Published by The Goodheart-Willcox Company, Inc., Chicago, Ill.

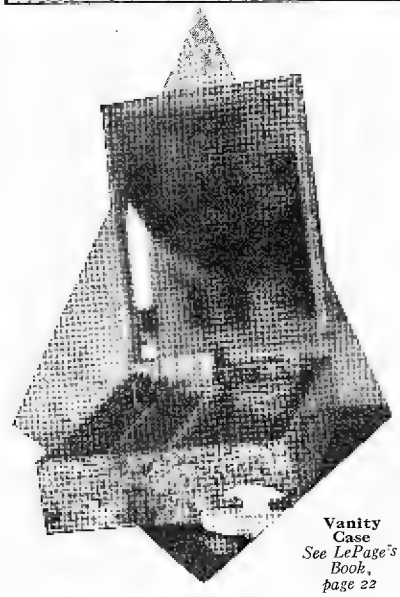
This valuable edition to aircraft literature familiarizes the student with the construction and principles of operation of the modern gasoline engines used for aircraft work. Such subjects as maintenance, assembly and inspection have been included. The service of the engine and all of its accessories has not been overlooked. The section devoted to aeronautical instruments and controls is very interesting, the text explaining the principle of each instrument and how to read it. Numerous illustrations accompanying the text, with each part marked and named, help greatly in making the book thoroughly understandable. Under the heading of "Aircraft Engine Lubrication," such subjects as oil pressure, oil temperature, and the like, are clearly explained. Master charts of full-page size are provided for each type of engine. A detailed index adds to the value of the book as a handy reference.—P. W.

Modernistic Fire Screen
See LePage's Book, page 13





Cape Cod Chest of Drawers
See LePage's Book, page 3



Vanity Case
See LePage's Book, page 22

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SAFETY AND PRODUCTION. A report by the American Engineering Council. Stiff cloth covers 6x9½ inches, profusely illustrated, 388 pages. Published by Harper and Brothers, New York City. Price $5.00.

Much statistical data concerning the relation of safety and production in industry has been obtained from time to time and has recently been compiled in this book by the American Engineering Council. The significance of the statistics presented is made readily apparent by the use of many graphical representations. The safety movement is described from the early period characterized by the passage of the first workman's compensation laws. Discussions of such phenomena as the increase in the number and severity of accidents despite the organized safety movement, are included. The subject matter is divided into sections, each section devoted to a different industry. This report does not place any blame whatsoever for conditions as they exist, nor for any aspect of the present situation. It does seek however, to show where lies the responsibility for initiating imperative improvements.—*DeW. B.*

THE ANT PEOPLE, by Hans Heinz Ewers. Stiff cloth covers, 5½x9 inches, 322 pages, profusely illustrated. Published by Dodd, Mead & Company, New York City. Price $3.00.

We doubt if there is a better popular book on Ant Life in print than the present volume. This book, which is a translation from the German, reads more like a story than a text book, and great credit goes to the translator, Mr. Clifton Harvey Levy, in handling a difficult translation.

It may be, that the present reviewer, himself an ardent ant student, is unduly prejudiced for the book, but even he wagers to say that it must be a dull person indeed who will not become thoroughly impressed and imbued with the wonders told in this book, particularly, for the layman this book will open up an entirely new world.

The great charm for the ordinary reader, however, is that it is written in non-technical terms, and that any twelve year old child will derive a thorough ant-education from this remarkable volume.

The illustrations that accompany the text are profuse. There are any number of plates, as well as line drawings. It is certainly the outstanding volume on the subject for the layman. —*H.G.*

THE STORY OF GEOLOGY, by Allan L. Benson. Stiff cloth covers, 6¼x9¼ inches, 298 pages, illustrated. Published by the Cosmopolitan Book Co., New York City. Price $3.50.

In this volume the author presents "The Story of Geology" in non-technical language for the lay reader, and has followed step by step the riddle of man's beginning, which we are able to trace millions of years back by the "writings" in the earth's crust. The book naturally begins with the origin of the planet earth and ends with the advent of man. Prof. Rayleigh in 1921, declared that from the information then existent, we could safely assume that life existed on this planet for a billion years, and that the earth itself was two or three times this age. When he said life, he did not mean that the human race had existed for a billion years, because the lower forms of life came first and then humanoid types afterward. "As yet, we have not all the facts nor can we completely understand all of them, but the more facts which we gain the better equipped we are to understand them and the greater is the age which we attribute to the earth." In this absorbing book we see how science has changed man's outlook upon this earth of ours and how speculation took a new turn when man began to learn something about astronomy, and the relation of our small mother earth to the innumerable number of visible and invisible planets which whirl throughout infinite space. In the absorbing story contained herein, the author relegates all the false theories and popular misconceptions to the scrap heap. "How little man had to start with is indicated by the fact that it has taken him 16,000,000 years to get where he is at the present time." This, of course, is the view of the evolutionists. Another view which seems slowly to be crumbling is that the Infinite Mind created man and for some unknown reason took 16,000,000 years to bring him along a crooked path to where he stands at present. Regardless of man's beginning, according to the author, our racial infancy is ending and happy times are in store for the human race.—*P. L. W.*

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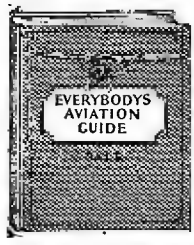

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Wood Turning for the Amateur

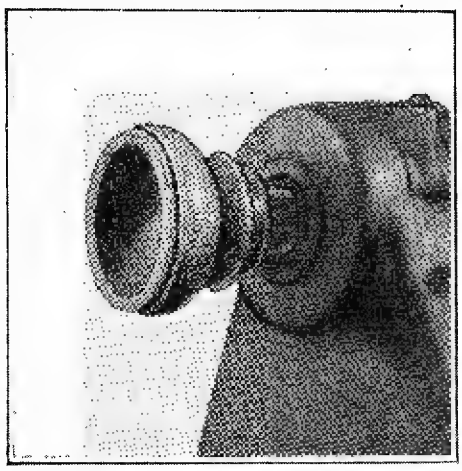
By H. L. WEATHERBY

(*Continued from page* 522)

painted at the locations given, using either enamel or lacquer, and then the whole job should be given two or more coats of white shellac followed by spar varnish to protect the wood from the weather.

THE STAKES

THE stakes are very simple, and no explanation need be given for turning them.

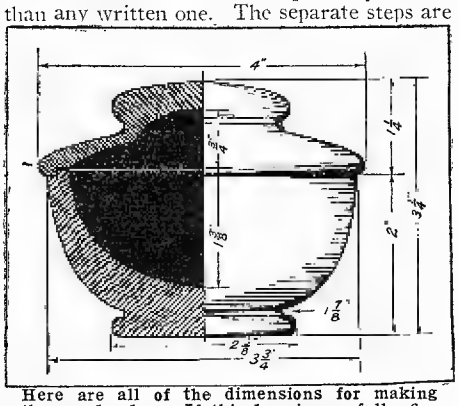


After turning the lid on the inside, turn the box complete, as shown; at which stage it is ready for chucking the lid.

Each color represented in the set should be found in a separate band on the stakes.

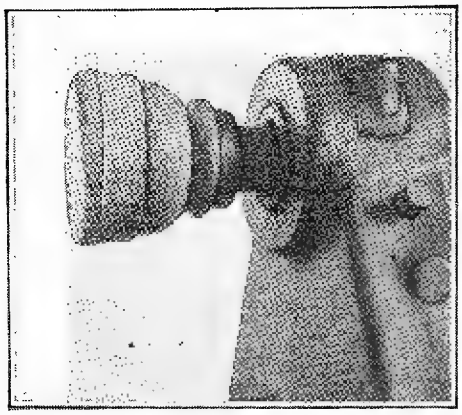
THE BALLS

A GRAPHIC explanation for the construction of the balls is probably clearer than any written one. The separate steps are

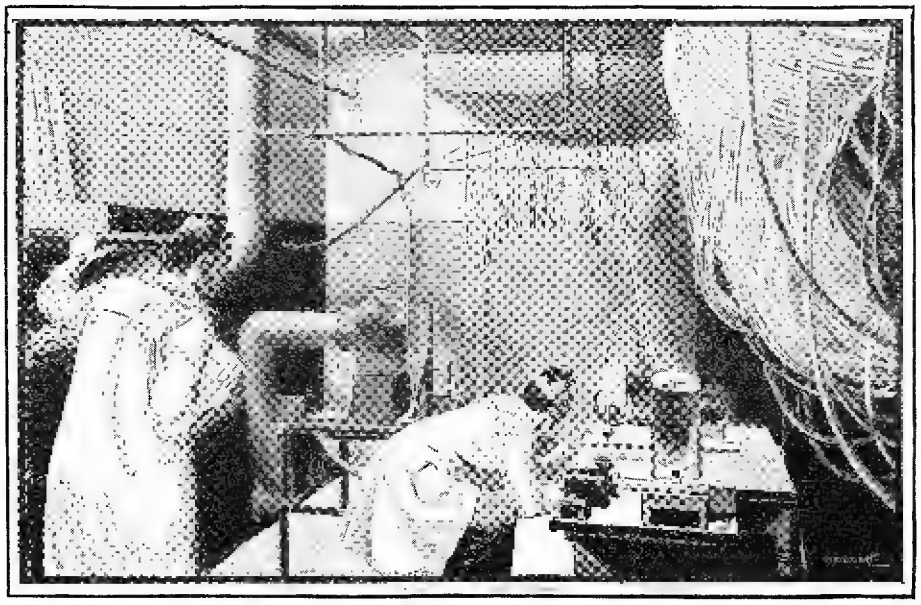


Here are all of the dimensions for making the powder box. If this box is carefully finished, it will greatly please the lady of the house. Powder boxes of this type also make excellent gifts.

illustrated, and if the first ball is not perfect, do not become discouraged, but try again. The chuck enters into the last stage, and



The rough lid in place ready for final turning.



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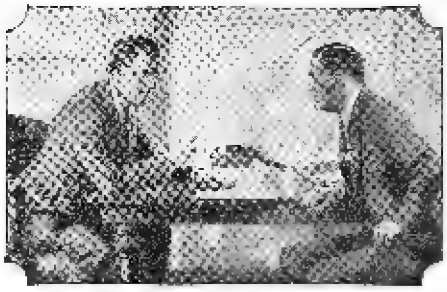

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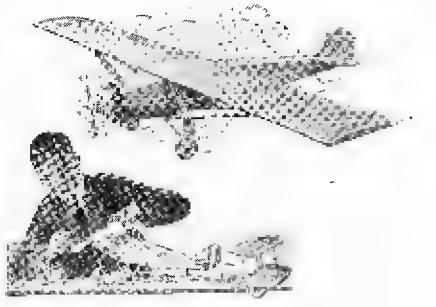

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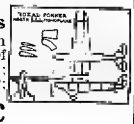

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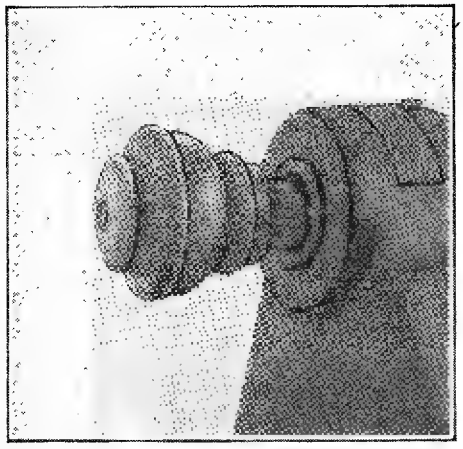
should be made from a piece of hardwood of a thickness to correspond to half the diameter of the ball. This block, mounted on a face-plate, should be hollowed out to fit the ball, and can be used for all subsequent balls of the same diameter. When all possible rounding has been done between centers, remove the ends as indicated, and press the ball well into the chuck and finish smoothing and sanding in several positions. The balls for the croquet set should be made from some hardwood, preferably maple, and finished as indicated for the mallets.

As stated previously in this article a four-, six- or eight-ball set may be built. To make the job complete, make ten wickets from heavy wire, as shown in the drawing, and build a wooden box to care for the completed set.



The completed box. If the lid fits too tight to be removed easily, remove the lid and cut a very small portion from the shoulder of the box before it is unscrewed from the face plate.

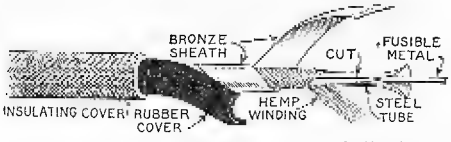
THE POWDER BOX

IN the case of the powder box we have a different class of chuck work. Start with the lid and cut out the inside or hollowed-out portion, being careful to keep the flange or shoulder that fits into the box square and to exact size. Next, remove the partially turned lid from the face-plate and fasten the block to the plate from which the box is going to be turned. Turn this portion completely, making the top of it to fit the lid, with a tight press fit. Now press the lid onto the box and turn the top or outside of the lid.

The box carefully finished, filled with powder and fitted with a puff, makes a most welcome addition to milady's dressing table.

The next installment will take up French polishing and give instructions for the turning of several small articles which may be finished to advantage by this method.

AUTOMATIC FIRE ALARM WIRE



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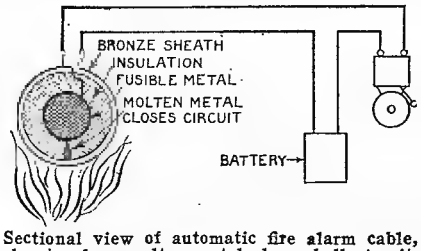

Sectional view of automatic fire alarm cable, showing how molten metal closes bell circuit.

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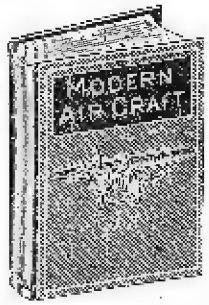

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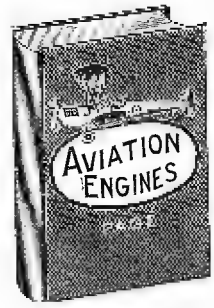

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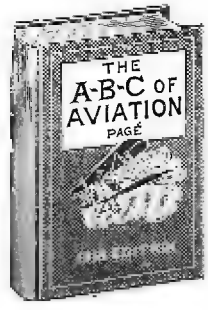

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The Human and Auto Engines

By C. T. SHAEFER

(*Continued from page* 501)

can work properly. They will both lack vitality to a very marked degree, and neither can be expected to give of its best. Undue forcing before a reasonable temperature has been reached in either case will bring serious after effects.

When an engine has stood for some time and becomes thoroughly cold, the oil, the life blood of the engine, has become thick, as oil does when cold, and all metal of the engine is cold, in other words, all joints are stiff. In the human body life itself and the correct performance of every bodily function depends primarily upon the quality of the blood and the certainty of its circulation to other parts of the body in proper quantity. Correct lubrication is no less essential with the motor car engine, regardless of its application. Take, for instance, the blood of a man who leads a sedentary life—that is, a life of ease. It is going to show up different than that of a man who indulges in the hardest sort of manual labor. Likewise in the case of the engine, an oil that is ideally adapted to one type is not going to give the best possible service in another of totally different design and application.

ILLS

WHAT happens or what must happen to bring the engine back to life when the joints are stiff? It must have a little rich food introduced into its stomach, but the stomach, being cold, is not in condition to readily do its part towards digestion of this rich food, and the spark, which is equivalent to the gastric fluid mixed with the food in the stomach of the human engine to cause digestion of the food is unable to do its part toward digestion and nothing happens. Continual repetition causes the engine to come to life slowly, but life is at a low ebb, and for some time the bulk of the power contained in the fuel is used for the production of heat to loosen and warm the joints and thin the oil.

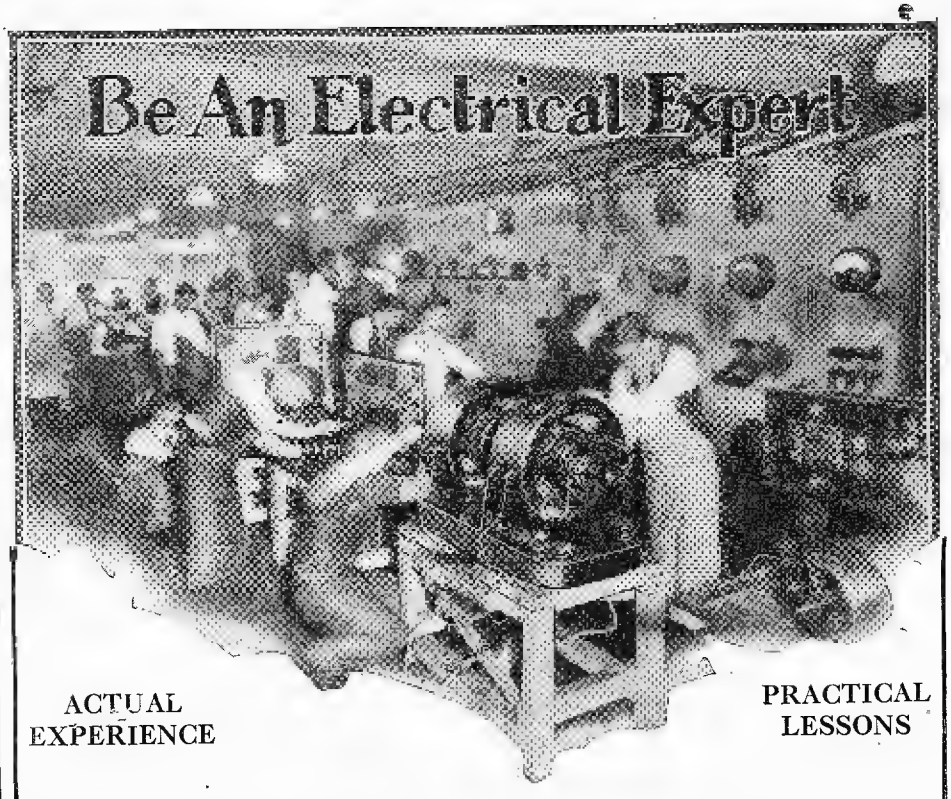
As the oil is thick and not flowing freely, the heart of the engine—the oil pump—is working hard trying to build up enough pressure to force the thick oil through the ducts and tubes. If the engine is run too fast or forced, a bearing may easily be damaged through insufficient lubrication. Then there is the possibility of the pump clogging. A stoppage of the heart in either case means disaster.

The cylinders and pistons are often called the lungs of the engine. These lungs must be in good condition if the engine is to draw in its proper ration of food and then prepare it properly for combustion so that the full power or energy may be obtained from

(*Continued on page* 551)

IN "RADIO NEWS" FOR OCTOBER, 1928

The "Combine" Receiver—This Month's $100 Prize Winner. By W. H. Schepple.
A Completely-Shielded Short-Wave Receiver.
"The Milk-Shaker Special"—a Screen-Grid Set for the Beginner.
Seeing Music with a Television Receiver—a Constructional Article.
The Search for the Perfect Amplifier—with Some Unusual Circuits.
The Radio Bean Sorter—a Photoelectric Novelty.
How to Build from the Schematic—Part II.
Radio Wrinkles.



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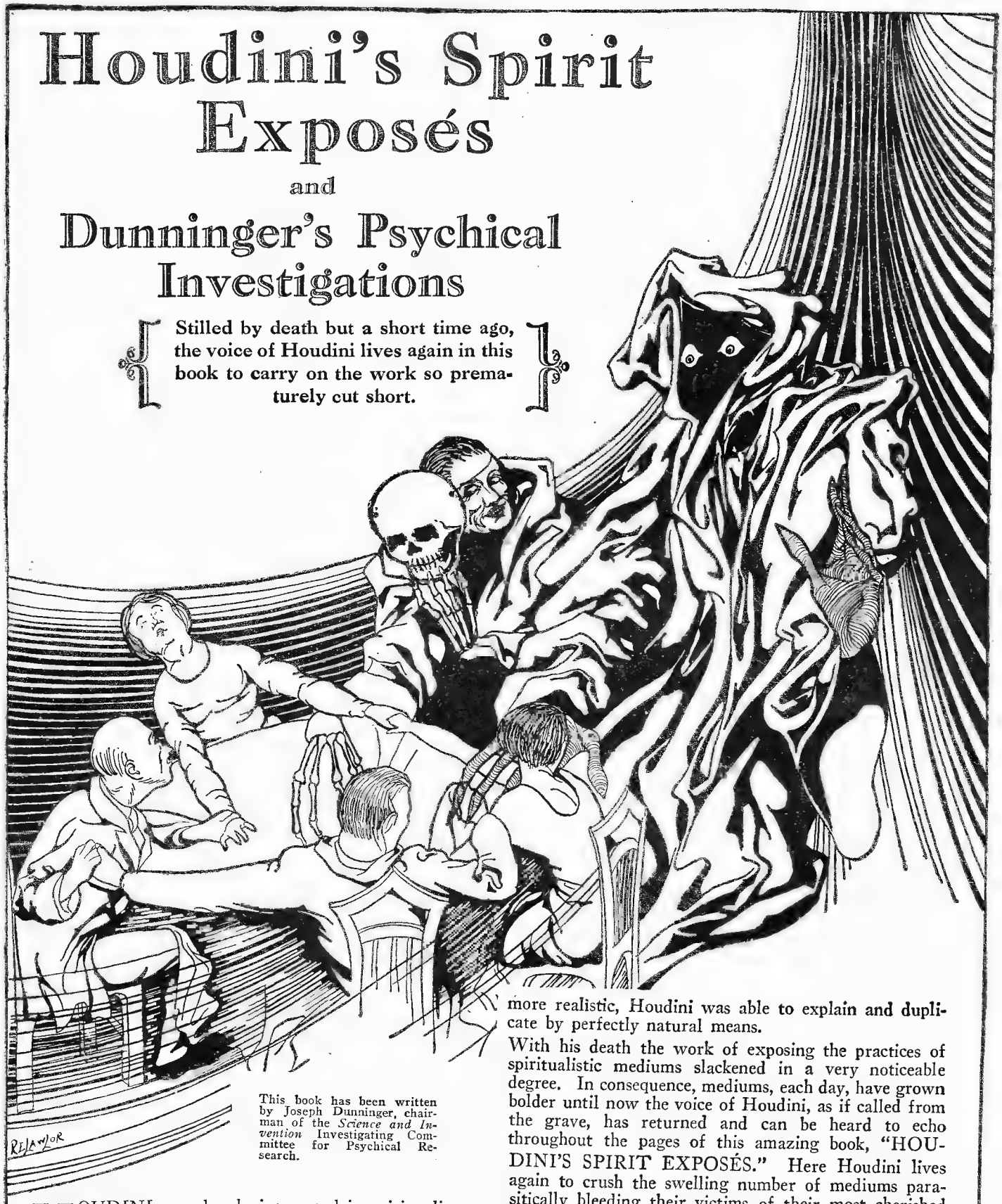
Houdini's Spirit Exposés

and

Dunninger's Psychical Investigations

Stilled by death but a short time ago, the voice of Houdini lives again in this book to carry on the work so prematurely cut short.



This book has been written by Joseph Dunninger, chairman of the *Science and Invention* Investigating Committee for Psychical Research.

HOUDINI was deeply interested in spiritualism. He spent years in the study of this fascinating subject. When he had fully mastered every angle, he turned his attention to exposing the fraudulent practices of mediums. Mysterious voices in the air, unearthly tappings on the table, weirdly moving furniture, floating figures, hands, lights—every trick employed by mediums in order to make their séances more realistic, Houdini was able to explain and duplicate by perfectly natural means.

With his death the work of exposing the practices of spiritualistic mediums slackened in a very noticeable degree. In consequence, mediums, each day, have grown bolder until now the voice of Houdini, as if called from the grave, has returned and can be heard to echo throughout the pages of this amazing book, "HOUDINI'S SPIRIT EXPOSÉS." Here Houdini lives again to crush the swelling number of mediums parasitically bleeding their victims of their most cherished possessions while posing in the guise of the living dead.

All should read this tremendously interesting book. The entire treatise has been written from the personal notes of Houdini—a startling exposé on one of the biggest frauds of the day. Do not fail to get your copy—112 pages—fully illustrated.

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The Human and Auto Engines

(*Continued from page* 549)

the fuel. Weak lungs, in this case, mean, in effect, a reduced charge drawn into the cylinders and consequent reduction in compression and power. The valves—the nasal passage—must also be in good condition if the engine is to function efficiently, as these bear the same relation to the cylinder as the nasal passage does to the lungs, except that they don't filter the air, which the nasal passage does.

There is an extremely fortunate difference between the human engine and the motor car engine. If the human engine is allowed to get cold enough and the heart to stop working, it is then inanimate and cannot be reanimated. When the motor car engine is allowed to get cold, it is also inanimate, but fortunately it can be reanimated, but it cannot reanimate itself.

Our analogy leads us to the conclusion that feeding and circulatory methods and the temperature conditions for both engines are quite similar. As in the case of the human engine, with proper treatment the ills of the motor car engine can be averted, or, after they develop, cured, providing the symptoms are correctly interpreted and the case properly diagnosed. Both in the matter of preventing these ills and in the matter of correcting them when they have developed, the motorist is dependent upon the motor car doctor, trouble shooter or diagnostician, as we may desire to call them.

Capability along these lines requires extensive training, and considerable missionary work is being done by all manufacturers to educate all interested, and the least the layman can do is to accept the advice of those who have made a study of the engine's anatomy to offset or remove the cause of trouble before it has gone so far as to render repair work an extensive proposition.

RULES FOR MODEL CONTEST

(*Continued from page* 516)

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based on: A—novelty of construction; B—workmanship; C—operating efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.

2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.

3. Models may be made of any available material, preferably something that is cheap and easily obtainable.

4. Models must be submitted in all cases. Good photographs are also highly desirable, and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.

5. Models should be securely crated and protected against drainage in shipment and sent to us parcel post, express or freight prepaid. Models will be returned when requested.

6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the December contest must reach us on or before the 25th of September.

7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

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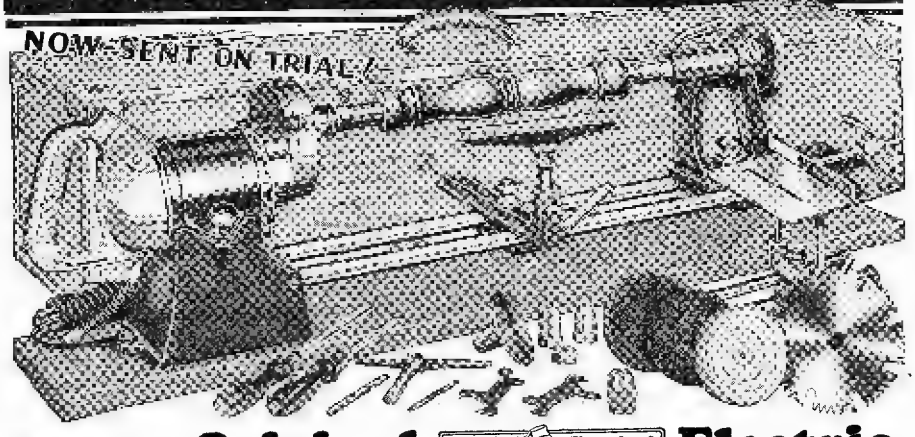
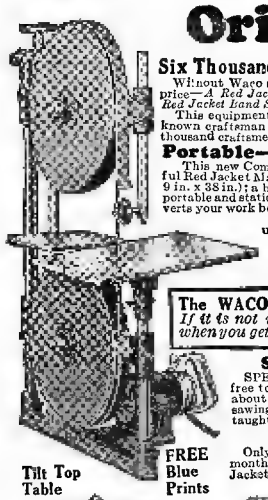


Original Red Jacket Electric



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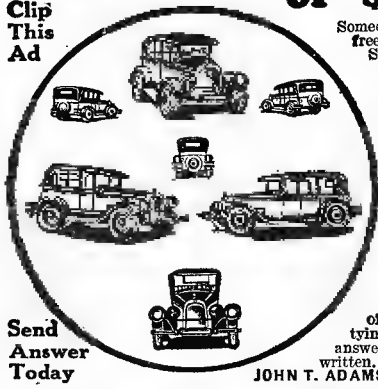

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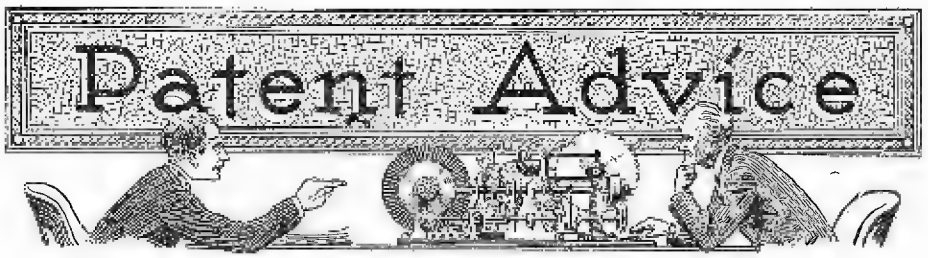

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Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches, and descriptions must be clear and explicit. Only one side of sheet should be written on.

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COMPRESSED AIR GUN

(1123) Joseph Chester, New York City, has designed a gun for warfare purposes consisting of a motor, pump, plunger and bullets to be struck by the plunger.

A. 1. We do not believe that the gun you have designed is of any particular value, because the force exerted is not great enough, nor do we see the necessity of using six pumps in an object of this type. One pump would be amply sufficient, the installation working like a riveting hammer. Nevertheless, the bullet would not be propelled by a force anywhere nearly as great as that which one obtains from gun powder.

We advise no further action.

GAME AND DRILL

(1124) George R. Jobey, Fort Leavenworth, Kansas, asks our opinion of a magnetic drill and a card game.

A. 1. The drill idea seems to us to be quite good. We do not doubt but that, if properly exploited, an article like this would meet with a market. There are, however, cases where people will not care to have a drill of this nature, because of the possibility of marring the work due to the magnetic foot.

We do not think that the game idea you have advanced is of any value whatever. There is already a game of a similar type in existence differing from your device in that you are merely using different indexes. This is not necessarily a good patent claim. The present game having worn out its welcome, there is a little chance that yours could find an appreciable market.

LIGHT

(1125) W. Raleigh Hall, Jeff, Ky., asks if he should get a patent on a product which, if put on a candle, greatly improves illumination.

A. 1. We think it certainly would be a good idea to get a patent on a product which, when placed on a candle, will give as much light as one can get from an incandescent gas mantle. It will be necessary, however, that this product be as cheap as an incandescent mantle, and that it will not be any more fragile, or if in powder form it will not increase the cost of burning to an appreciable extent. You could, for instance, take magnesium and place magnesium in a candle flame and get as much light from the candle as you get from any source of gas illumination, but this means is highly unsatisfactory because of the price of the magnesium.

If you are positively assured of the value of this product, we advise further action.

ROCKET PLANE

(1126) Leo. B. Frisch, Chicago, Ill., has designed an airplane with a multiplicity of wings and groups of rockets on each wing. He wants our advice.

A. 1. The idea of an airplane with rockets on the wings is not new. You will find that one was described in a recent issue of SCIENCE AND INVENTION Magazine, except that here the rockets are not on the wings, but on the body of the machine itself, which is perhaps a little better. Wing rockets were suggested years ago, and if you will look back through SCIENCE AND INVENTION Magazine for the past six or seven years, you will find the idea repeatedly approached.

It is questionable whether a patent on a suggestion of the nature you have described will be of any material benefit and we advise no further action.

GASOLINE DISPENSING SYSTEM

(1127) John F. J. Fay, Los Angeles, Calif., asks if he should patent a coin in the slot gasoline dispensing machine.

A. 1. It is impossible today to completely protect any kind of a slot machine device so as to prevent another organization from gaining a foothood with a similar system. If you could manufacture a gasoline vending machine operating on the slot principle, which could be so changed that the gasoline dispensed would vary directly in accordance with the coin dropped into the machine and which could be automatically shifted with the daily changing market prices, it is possible that some protection might be gained. The difficulty will be in securing a basic patent which will be upheld by the courts. This, as mentioned before, is almost an impossibility, hence, if your mechanism has once met with success, other manufacturers may duplicate this.

TALKING PICTURES

(1128) Rocado Truque, Costa Rica, C. A., asks us if it would be advisable to patent an idea of a motion picture film with a steel band forming the perforation, and running along with the film, on which steel band the voice is inscribed by the telegraphone principle.

A. 1. The idea which you have advanced for a motion picture film, the edge of which is made of metal, and on which is impressed the voice, is not a new system. The telegraphone has proven very impractical in the reproduction of voice in the manner you have designed. A breakage of the film cannot be practically repaired, and the voice constantly decreases in intensity. It is likewise quite impossible to secure a patent on an idea encompassing two patented systems. The mere idea of coupling the telegraphone with a motion picture machine does not constitute patent claims. The method of this coupling is the all-important consideration, yet any change in coupling method would enable someone else to duplicate the effect.

We advise no further action along this line.

RADIO CONE

(1129) H. N. Webster, Newark, N. J., asks whether he can patent a loud speaker using celluloid as the product from which the cone is made. Also whether it would not be advisable to place windings upon the pole pieces of a loud speaker of the Western Electric type.

A. 1. The suggestion for making a cone loud speaker using celluloid as the diaphragm is not at all new and you will find that many cones have been built with this product.

The type of a material used in the construction of a loud speaker cone is not a claim for a patent unless that material is purposely compounded for that type of instrument. You could use wood, glass, paper, celluloid, ivory, bone, gelatine, or what not, and yet not be able to secure a patent.

While it is perfectly possible to place windings on the pole pieces of a Western Electric type of cone, this is not done, for the simple reason that the operation of the cone becomes considerably more expensive. In power cones designed for volume, electrically magnetized field pieces are used. A very good example of this is the Magnavox.

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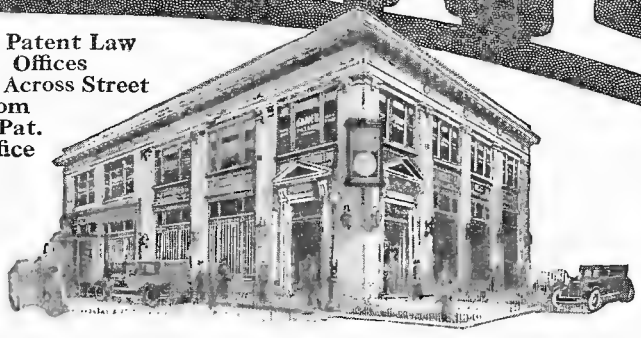

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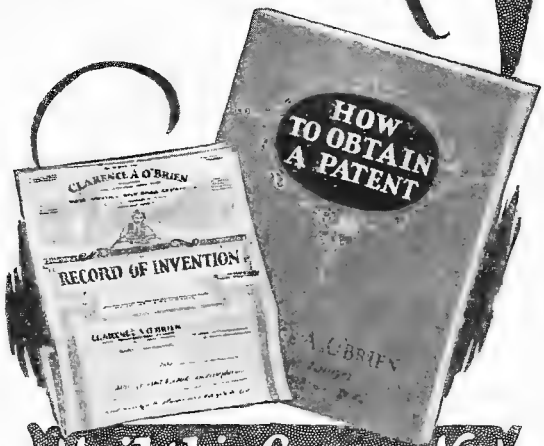

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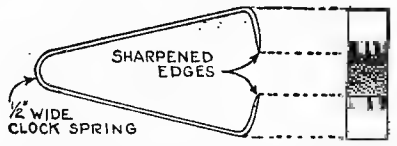
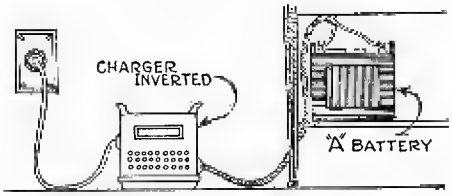


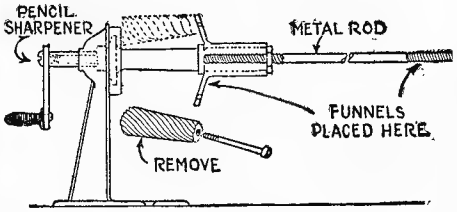
A simple device for stripping the insulation from wires can be made from a 9" length of clock spring ½" wide. The ends of the clock spring are filed to a sharp edge and it is then bent as shown in the above illustration.—Charles F. Felstead.

CHARGER KINK



A battery charger using a Tungar or Rectigon bulb will last longer if inverted. After many hours of operation, the tube filament acquires a sag and its life may be lengthened by using it in an upside down position where it will assume a normal shape.—Charles D. Savage.

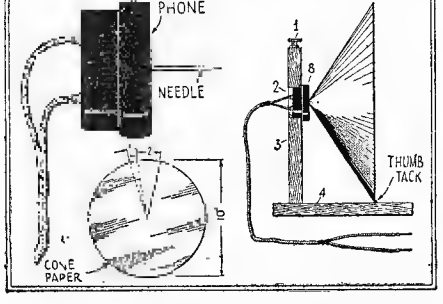
COIL WINDER



A coil winder can be made from a pencil sharpener by removing the grinding blades and the gear piece. The metal rod is removed and filed on one end so that it will just slip into the frame. It should then be screwed onto the frame permanently. Two tin funnels about 4" in diameter are slipped over the rod and are held in place by two rubber discs which fit inside of them. The form can also be used for spider web and Lorentz coils.—H. Henstell.

PHONE CONE SPEAKER

A cone speaker can be made from a pair of headphones by soldering a needle to the center of the phone diaphragm as shown.



Details for the paper cone are also given. It should be about 10" in diameter. Sealing wax is melted and dropped into the apex of the cone. Next, the needle on the diaphragm is heated and pushed into the sealing wax. The cone is mounted upon a wooden stand. In the illustration 1 is a set screw, 2, hole for holding phone; 3, upright support; 4, baseboard. A thumb tack placed at the bottom of the cone assists in holding it in place.—Arnold Rankin.

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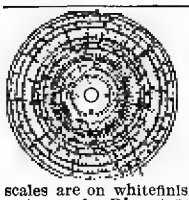

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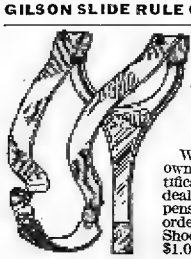

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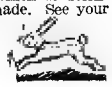

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The Unfinished Radio

By EDNA BECKER

(*Continued from page* 509)

Brent smiled sickly. "They must have expected to, or they wouldn't have taken the trouble to steal them."

"Well, they're gone." Goreham laid a fatherly hand on the younger man's shoulder. "Suppose you make a clean start now. Show us what you can do and—cut out the running around."

KIDNAPPED!

AFTER the police had come and gone, Brent went to see Gwynneth—the last time for a long, long time, he told himself. He must get down to business. It was after midnight when he reached his rooms and as he was unlocking the door, a circle of light fell on him. Somebody said, "Stick 'em up, Buddy."

When Brent saw an automatic staring him in the face, he slowly lifted his arms.

"See if he's got a gun."

A second man felt Brent's pockets. Finding no weapon, he took him by the arm. "Come on; you're going with us."

It was late, the streets were empty, and he was outnumbered. Seeing that resistance was useless, he went quietly. A car stood at the curb. Brent was shoved inside, and was blindfolded as the car moved away. They went around many corners, and when the car stopped half an hour later, Brent had no idea where he was. His captors dragged him out of the car and up some steps, then down a great many steps. At last he was shoved into a room and told to go to bed, and to get ready to talk in the morning. "And if you do any hollering, we'll come in and gag you," said one of the men as he locked the door.

It took Brent some time to remove his blindfold. When he could see again after the effects of the pressure on his eyes had worn off, he saw that he was in a large room of solid masonry. It had two small grated windows so high up that he couldn't see out of them, and a third larger window, also grated, which opened into another room. These were the only openings besides the door through which he had entered.

The room was dimly lighted, the light coming in through the window which opened into the other room. He stepped over to this window, and made two astonishing discoveries; that the adjoining room was a large laboratory; and that his stolen apparatus was on the table. So that was what they wanted him to talk about. They'd wait a while.

He looked around his own room again. It contained a chair, a table, a cot with some tumbled covers on it, and a washstand. High up was a light fixture, but no switch. It seemed that he must stay in the dark. Just then the light in the other room went out, and there was nothing for him to do but to grope his way to the cot and lie down.

"Guess I go to bed whether or no. Pretty mess this," he muttered, as he pulled a musty smelling quilt over himself. As he reviewed the happenings of the evening, he realized that the possibility of his being rescued was slight. No one would have an inkling of what had happened. Goreham might be able to trace him through the theft, but that was doubtful, yet he felt sure that his employer would find him eventually. Goreham had been mighty decent to him, he reflected, and one thing was sure: he didn't talk in the morning. He went to sleep feeling very loyal.

When he awoke it was daylight, or he supposed it was, for two pale rays of sunlight

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shone in through the two small windows, but the room was dim in spite of them. He made a round of investigation, but it only confirmed his conclusion of the night before—that there was no way of escape. He washed his face and hands in the granite wash-basin, and made an attempt at shaving with cold water and a dull razor he found in the table drawer. He was just finishing when the key grated in the lock and his two jailors entered.

"Morning, Buddy. Here's your breakfast."

"What the devil do you want with me?"

"Eat your breakfast and then we'll discuss that."

Brent was hungry and began on a platter of crisp toast and perfectly poached eggs. When he had finished he tried again.

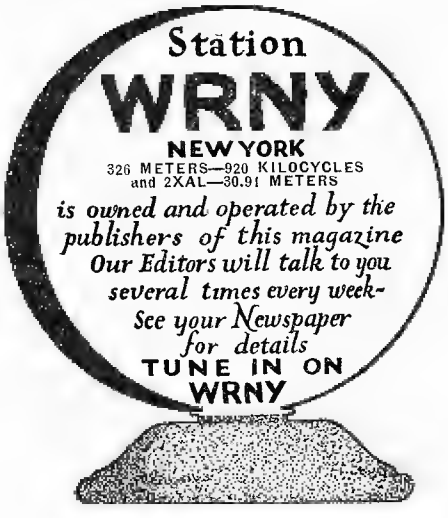
"Now spill it! What do you want with me?"

"I guess you know all right. When you get ready to work out that tube for us—the one all those notes are about that we can't figure out—knock on the door."

"You'll wait till hell freezes over before I tell you."

"Naughty, naughty," said one of them as they went out.

Brent never spent a longer morning. He had plenty of time for reflection, and decided that he had been kidnapped by their rivals, Sharkley & Co., and was being held prisoner in an attempt to steal the best idea that had ever come to him. Of course he might be mistaken, but he wouldn't put a thing like this past old Sharkley, for he knew he was unscrupulous. He had tried repeatedly to get Brent to come over to him, but he, Brent, had remained loyal to Goreham, who had taken a personal interest in him, and whom he admired as a man.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TUNE IN ON WRNY

"I'll show them with their dirty tricks. They can be thankful I lost my head over Gwynneth or I'd have put this idea over long ago," he thought.

Noon brought his captors with a tray of well-cooked food. "Ready to go to work?" said one as he set down the tray.

"Not by a jugful."

His jailor's eyes squinted, but he remained cheerful. "All right, Buddy; just as you say. But mind you, let us know when you are ready. Just knock on the door."

TORTURE

WHEN they had gone, Brent decided he would take a nap, but he had no more than settled himself when a loud hammering began. Thinking it was a steam pipe, he paid no attention to it. An hour passed and it did not stop. Tap, tap, tap tap, tap, tap tap tap, it went, sometimes irregularly then regularly—tap, tap, tap. tap. As Brent had nothing to occupy him, his attention was held by the tapping. Soon his nerves began to protest. Hour after hour it continued. In time it dawned upon him that it was not a steam pipe after all, but was rather a trick

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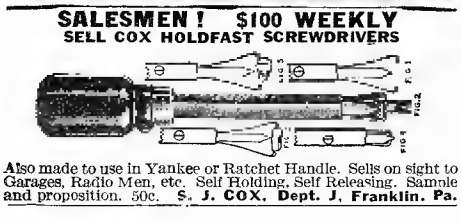
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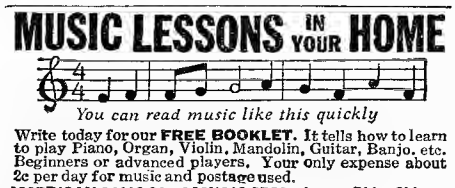
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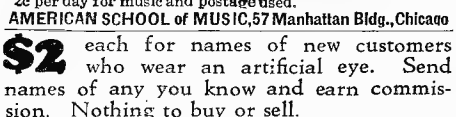
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of his jailors to make him talk. They'd wait a while, he thought.

All afternoon it continued until Brent thought he could not endure it any longer. When at last it stopped, he rose from the chair where for the past hour he had been sitting with his elbows on his knees and his fingers in his ears, and began walking about to relieve his crampled muscles. He was as tired as if he had done a long, hard day's work.

A GIRL COLORS THE SCENE

SOON he heard the key turn, but did not face about until a light step sounded and a whiff of delicate perfume met his nostrils. A girl had brought his tray—a little beauty, too, he thought, noting her light, waving hair, shining brown eyes and a sweet, laughing mouth.

"Here's your dinner." Her voice, too, was sweet.

Even as Brent admired, he thought quickly Perhaps in her lay a way of escape. If he could gain her confidence, perhaps he could send word through her. "Won't you sit down and eat with me?" he asked.

"I've eaten, thanks," she said, perching herself on one corner of the table.

"The food is the one thing I can't complain about."

"Thank you! I'm the cook."

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They chatted companionably while Brent ate. The girl was friendly and before long Brent was attracted by her charm. "How long are they going to keep me here?" he asked in an effort to feel her out.

She laid her finger on her rosy mouth. "Mustn't talk."

"This can't make any difference. Isn't there any way I can get out?"

"Not unless you do as they ask."

"That's out of the question," he said, rising.

She slipped down from the table and came over to him. "I'd consider it, because . . ." she hesitated, "I'd hate to see anyone treated the way they're planning to treat you, and I—I like you."

Brent took the tray out of her hands. "Don't go. I like you, too."

The door was flung open and the tall jailor entered. "Say, what do you think this is?" he demanded. "An afternoon tea? You can't stay in here gassing with this bird forever!" Brent gave the girl's hand a quick pressure as he handed her the tray and she smiled back at him.

After she had gone, he felt almost hopeful. By this time, dusk was thick in the room, and while Brent was deciding whether to go to bed, a light was turned on in the adjoining room, and a man whom he had not seen before came in. Soon the two others joined him, and together they pored over Brent's

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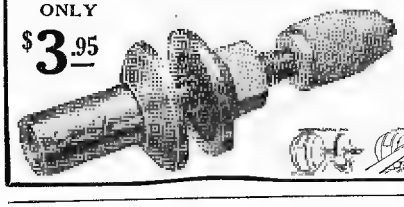

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notes and drawings. After an hour they gave up and turned out the light. Brent perforce went to bed.

Soon after he fell asleep, the light in his room began flashing and wakened him. He sat up and blinked. It went off and he lay down again. The light came on. On and off; off and on. Sleep was out of the question. Sometimes the light flashed quickly like lightning; other times it stayed off for five or ten minutes, but always just as he was falling asleep it came on again.

Brent's head began to ache and his eyes smarted. He covered his head with the musty quilt, but soon flung it off deciding he would as soon see the light as die of suffocation. The light was off and as he lay there waiting for it to come on again, he thought he smelled smoke—coal smoke. When it did, he saw that a funnel had been stuck through the window and that smoke was being blown in, not very dense smoke, but dense enough to make him cough. He had covered his head and was breathing through his handkerchief when the pounding began again.

The next hours that passed were calculated to bring acute torture to a finely strung nervous system like Brent's. Assailed through three senses, sight, sound, and smell, his persecuted nerves cried out. Oh, for a breath of fresh air!

He was coughing constantly when something wheeled up to the window. What next? The room was in darkness, but he was not kept long in suspense. His covers sailed away as a powerful blower began roaring. He retrieved the covers, wrapped himself in them, and lay down again, but it was no use. One might as well try to sleep in a hurricane. He got up with the intention of moving the cot, but found that it was fastened to the floor. Wherever he went the gale followed him, roaring past him so violently that his ears fairly flapped. It blew the smoke away, though, and that was something.

At last he wrapped the covers of his couch around him like some Biblical patriarch, crawled over to the window, lay down a little to one side of the blower, turned his face to the wall, and grimly waited for morning. And to have peace, he needed only to knock on the door!

With the coming of dawn, the light, the blower and the hammering stopped simultaneously. Brent's weary body relaxed. Fearing to go back to his cot, he remained on the floor. His ears roared, his skin felt dry, light danced before his eyes, and his head felt big as a barrel. "Lord! What a night!" he groaned. Then, exhausted, he

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fell asleep almost instantly. Two hours later his jailors came with his breakfast, and unmercifully shook him awake.

"You dirty dogs!" he growled.

"Now, Buddy, this ain't nothing compared to what's coming, if you don't loosen up," said one. "Say," he became confidential, "we got a room all ready with a big, soft bed in it, and a carpet on the floor, and a bathtub. And there's a little room off to one side where you could eat your meals with the pretty girl. Better think it over."

"Get out of here," shouted Brent.

JULIE OFFERS TO HELP

SEVERAL days, much like the first one, passed. A number of new annoyances, calculated to break down Brent's control were added. The fifth day found Brent very, very tired—tired almost to exhaustion. When Julie brought his lunch, she found him in a deep sleep.

"I hate to wake you, but you have to eat," she said as he wearily opened his eyes.

Julie was the one bright spot in those fiendish days, and Brent looked forward to her visits with pitiful eagerness. She was sympathetic without being obnoxiously so. Brent felt that she was his friend.

"I wish you would eat more," she said when he pushed away a plate of food which he had barely tasted. Then impulsively. "I wish I could help you. But I can't mail your letter. I've given my word that I wouldn't and I—I couldn't break my word, even to them. I have a way, though, to help you; that is, if you could trust me enough."

Brent smiled faintly at this, but Julie was in earnest. She leaned forward and looked him squarely in the face, and said:

"Do you trust me? Could you trust me enough to give them the tube and believe that I have a better plan?"

The tall jailor flung open the door at this juncture and informed Julie that it was time to leave. But before she went she bent down swiftly and whispered: "Think it over. I really mean it."

Was she trying to entrap him? He wondered after she had gone. Her eyes were true.

All afternoon a whistle went OUUUuuu UUUUuuuuu. It stopped at last, and after he had refused the tray the two men brought, he wrapped himself in his bed covers and lay down on the floor, a little to one side of the window. He no longer thought of lying on the cot, for his tormentors reached in through the window with a long metal hook which grasped his bed, and shook it. If he chose any spot other than that beside the wall, they prodded him till he moved there out of reach. But to-night there was no light, no tapping, no whistle, no blower, or no smoke.

Brent noted this ominous calm, but was too exhausted to spend much time in wondering about it. He fell asleep at once, but his sleep was troubled. Several hours later he was wakened by a scream, a terrible, shrill, long drawn out woman's scream that made his hair stand on end and his flesh crawl. He sat up, and his blood ran cold as he saw a hand whose luminous fingers worked horribly, reaching toward him.

They had taken advantage of his frayed nerves. He heard moans and groans. Things skated across the floor; things chuckled in the corners, and worst of all, things whimpered. It was enough to shake anybody. Brent came very near knocking that night.

When he got up in the morning he staggered as he rose. His clothing seemed much too large for him and as he took up the slack in his coat, he reflected that he must have lost fifteen pounds.

He was permitted a quiet morning, and when Julie brought his lunch she again found him asleep. Her face was grave as she woke him, noting how haggard he had grown, what deep hollows there were under his eyes. He could eat but little. She did not try to force him, but instead took up

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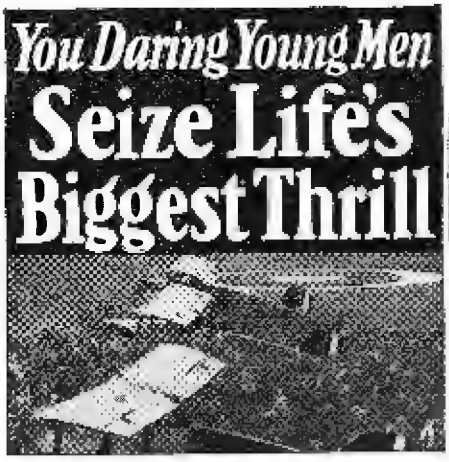

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their conversation where it had been dropped the day before. "I can hardly wait to hear what you have decided, but I'm going to explain what it's all about before I ask you. How would you like to give them the tube and make a radio so much simpler and better, that it wouldn't do them any good?"

"I think that would be wonderful," he said, but his tone belied his words.

Julie gave his hand a little spank. "I'm not talking just to pass the time. This was a dream of my father's. Poor daddy. He didn't get to finish it, but he gave me his plans and told me if I couldn't work them out, to give them to some honorable man who could. I believe you can and I—I would trust you with them."

A new look came into Brent's face. "I am immensely honored," he said gravely.

"I know it's a dreadful risk to ask you to take—to ask you to believe me, but it's the only way I see to help you—the only way to laugh in their faces."

Brent's eyes narrowed. "Gad! I'd love to do that."

The girl sat down beside him on the cot, and drew his head to her lap, saying, "Relax and think it over for a few minutes before you decide. I know it's hard to trust another person—especially one who belongs to the enemy—that much." She clasped her hands over his forehead and was silent till he spoke.

"Julie," he said at last, "maybe I'm a fool, but I'm going to take you at your word. You're not fooling me, are you?" he ended, rising and pulling her to her feet to face him.

She met his eyes steadily. "I'm not fooling you." She went to the door and pounded on it. "You can tell them that you're ready to go to work, and remember, they'll give you anything you ask for."

When the door was opened, Julie slipped out, saying, "Mr. Brent has something to tell you."

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BRENT GIVES IN

"WELL, what is it, Buddy?" demanded the tall jailor.

Brent looked at him and gulped. It was a humiliating moment. "I'm ready to go to work."

"Thought you'd come around pretty soon."

Brent, although he felt an almost overwhelming desire to smash him in the face, restrained himself and merely said, "See

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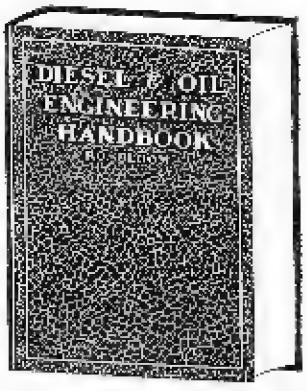

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here, I've got to have decent quarters and a few days of rest first."

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"Don't stand there gabbing. Get me out of here."

With a jailor on each side, Brent was escorted out of the room, up some steps and into his new quarters.

"Look around and see if this suits you," said one of the men as they went out, locking the door behind them.

Brent looked, and saw a bedroom, a bath and a small study. In the study where he stood was a deep leather chair, a davenport, and a desk with papers and drawings on it. He slid his feet ecstatically over the thick carpet. Beyond was the bedroom with its chest of drawers, bed with covers turned back invitingly, long mirror, and shaded lights. He shuddered when he remembered the blinking horror he had endured all those nights down below.

He went into the bedroom and opened one of the drawers. It was full of his clothing. He tested the bed. It seemed like eider-down compared with a cement floor, and he sighed a long sigh of anticipation. The bathroom was clean and shining. He ran his hand over the surface of the tub. How good it would seem to be clean again. Washing facilities had been poor in his basement cell.

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"All right. Send her in."

"I feel like a traitor," said Brent after they had seated themselves.

"I don't see why you should. You're going to beat them at their own game. There's nothing wrong in that."

"I hope you're right."

"I know I'm right and—I know you can do it." Her brown eyes were trusting.

Their eyes held for a long moment, then Julie said:

"I'll be running along now. Be a good boy and take a nap before dinner time.

"Don't worry about that, and don't send up any dinner because I probably won't wake up before morning."

"Just as you say, but if you wake up and are hungry," she smiled roguishly, "knock on the door." Then she held out her hand. "Good night, partner."

"Good night—partner."

BRENT FALLS IN LOVE

AFTER taking a warm bath and putting on a pair of his own pajamas which he found in the chest of drawers, Brent crawled gratefully between clean sheets. The bed felt deliciously soft to his tired, aching body. The price of treason. No, it wasn't treason: He would make good. Julie was true. He trusted her.

He was too tired to think long, and fell into a deep sleep from which he did not waken until afternoon of the next day. He lay there for a while then got up and

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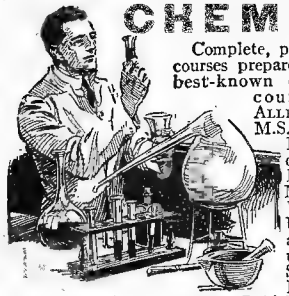

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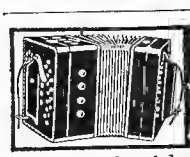

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dressed. Clean clothes! The luxury of them. When he was tying his tie the door was cautiously unlocked and his jailors entered.

"Thought you were never going to wake up," said the tall one.

Brent did not deign to reply.

"Still sore? No use, Buddy. I'll have Julie bring you something to eat in a little while and maybe you'll feel better."

Brent was looking out of the barred window when Julie came in. She was so much lovelier than he remembered that for the moment he was speechless. She wore a soft pink dress instead of her customary white uniform, and her beauty was startling.

"What's wrong?" she asked, as she caught sight of his face.

"You're the prettiest thing I ever saw."

She laughed gaily. "It's probably the dress."

"It's probably not."

"Would you like to have me eat with you?" she said, tactfully changing the subject.

The meal was a very gay one, and afterward Brent said, "Let's sit down and get acquainted now. I only know a Julie in a starchy white uniform who is kind and sympathetic."

"Don't you think this one will be?"

"I hope she'll be a lot more. I'm falling in love with this Julie." He hadn't thought of Gwynneth for days. She no longer counted.

"Don't be silly. Come on; let me keep my part of the bargain. They will insist on your going to work in a few days, and I want you to have my father's idea in mind first."

"All right. Shoot!"

First she told him about her father, of his inventive genius, and his poor business ability, of how he had been swindled out of a patent which was rightfully his, and of their resulting poverty, for he refused to go to his wealthy brother for aid. Then of his dream of a powerful radio which used neither batteries, tubes, nor aerial, an idea which would revolutionize the radio industry, and of his untimely death before he could complete it.

Brent listened to this recital with difficulty. It was all that he could do to keep his mind on what she was saying. Before long she sensed his restlessness, and said, "You poor boy! Are you still so tired?"

Brent smiled. "Not that. It's you; you overwhelm me. I can't think of another thing."

"But what good will that do? It won't build a radio."

"If you'd let me kiss you once, I could do anything."

She hesitated. "Is that a promise?"

"That's a promise."

Both of them were a bit breathless. Julie looked at him for a long moment as if trying to read what was in his mind, then offered her ripe mouth. Brent's arms went around her, and as he kissed her, he realized how overwhelmingly he loved her.

He kissed her again, and she made no protest. Presently he felt something hot on his cheek. She was crying! He held her off and looked at her.

"You love me!" he cried triumphantly.

She hid her face against his shoulder. "Couldn't help it; you were so b-brave."

"Oh, my dear!"

When they came back to earth again, there were a great many things to talk about, but before she left, Julie showed him her father's plans and drawings.

Much later that night as Brent sat at his desk looking them over once more, he realized that the idea was sound. If only he could translate it into metal. The next few days were days of intense concentration, broken by intervals of ridiculous happiness when Julie called. As the days slipped past,

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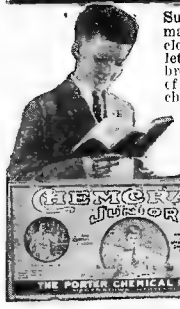

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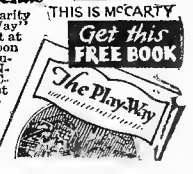

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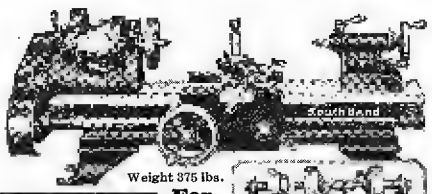

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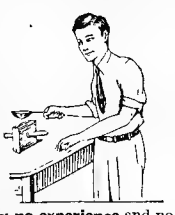

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his jailors began growing impatient and demanded:

"What do you think this is, a boarding house de luxe?"

"You can't half kill a man and expect him to go to work the next week," Brent had retorted.

"You're pretty spry for one who's been half killed. You go to work tomorrow, or it's the cellar for you."

"All right. I'll go to work tomorrow, you little angel."

That night after Julie had gone, Brent sat at the desk thinking, thinking. The idea stood out clearly—all but one point. That wouldn't fit. He sat there for a long time, but it was useless. Finally he went to bed knowing himself well enough to realize that such things couldn't be forced. Given time, he felt sure that it would come to him. He fell asleep thinking about it, and when he woke the next morning, the solution lay before him like an open book. His subconscious mind had done the trick. It seemed almost uncanny, yet all the ideas—the ones that really counted—had come to him either just before falling asleep, or in the moment of waking. He knew that this was true of many people, and welcomed his new brain-child gratefully. It would work. He knew it would, for he had that feeling about it which never lied to him. Now for a chance to try it. He'd give them the tube, and make a radio that didn't need tubes or any of the rest of the usual radio accoutrements. He who laughs last

. . . .

THE TUBE IS COMPLETED

IN due time Brent completed the tube. He was preparing for the demonstration—was arranging his apparatus, when the laboratory door was opened. He turned to see who it might be and gasped when he saw that it was Goreham with his arm around Julie's shoulders. Beside him walked Kline.

"Well, well, my boy, how are you?"

Brent could only stare.

Goreham came over and grasped his limp hand. "Congratulations. Julie has told me all about the new radio."

"Julie t—told—" Brent stuttered.

"Yes. Julie's my niece. Just came to live with me for a few days before you got kidnapped."

Everybody laughed but Brent.

"What do you mean?" Slowly it dawned upon him. "Do you mean to say you framed this on me?"

Goreham beamed. "Kline thought of it. We planned it all that day after you came to the office to see me. You must admit that you needed something drastic. We had to hurry like everything to get this place ready. We just had a day. But you came through wonderfully, my boy, wonderfully. You had us going for a while, though, for fear that you wouldn't come across. But it all turned out just as we planned. We're proud of you."

A struggle was going on in Brent between his sense of humor, and the memory of the treatment he received. Finally his sense of humor triumphed. "Well you old son-of-a-gun."

"Let's have a squint at the new tube." said Kline.

While they were so occupied, Julie slipped her hand through Brent's arm, and raised serious eyes.

"Can you ever forgive me?"

Brent smiled down at her. "On one condition."

"What?"

"That you were'nt fooling, too."

She flushed delightfully. "I was never more serious in my life," she said slipping her hand in his.

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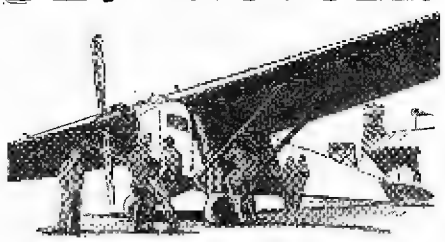

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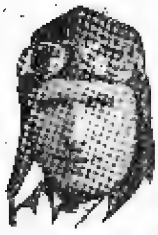

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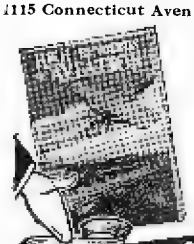

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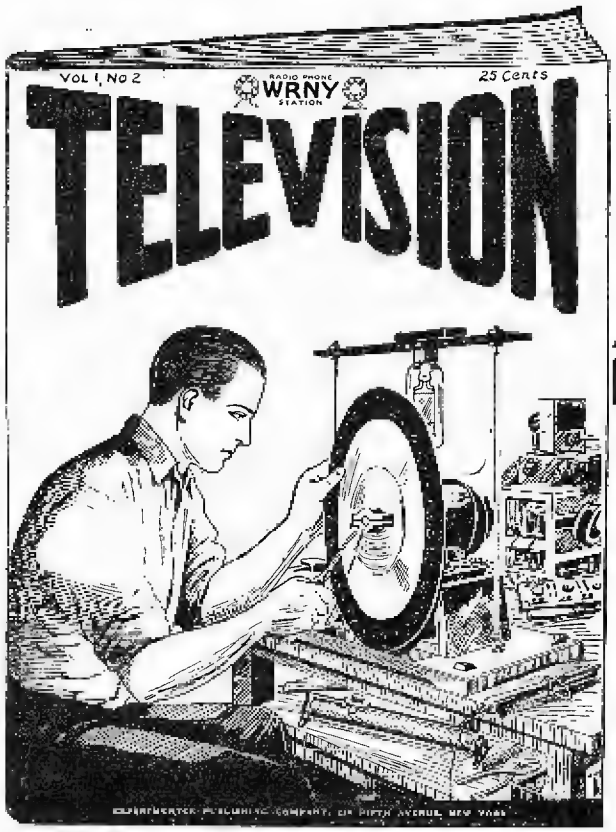

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A Wardrobe Cupboard in Plywood

By J. E. LOVETT

(*Continued from page* 521)

being 4 inches long. The plywood should be about ½ inch thick, and taking the foregoing measurements as a basis, the following pieces are required:

Two doors, 4 feet 5¾ inches high, 1 foot 8½ inches wide, finished sizes, which allows for the application of a moulding ¼ inch thick to the two edges and to the top.

Sides, two of these, each 4 feet 6 inches high, 2 feet wide; one top and one bottom board, each 3 feet 5½ inches long and 2 feet wide; one centre division panel, 4 feet 1½ inches high, 2 feet wide.

The back is an ordinary three-ply sheet about 3/16 inch thick, 4 feet 2 inches high, and 3 feet 6 inches wide. The material for the drawers and trays is as follows: ½ inch plywood:—

One for each drawer; fronts, 9 inches high, 6 inches high, 3 inches high, 1 foot 8¼ inches wide.

Two for each drawer; sides, 8¼ inches high, 5 inches high, 1⅞ inches high and 1 foot 9 inches long.

Six tray sides, 3 inches high, 1 foot 9 inches long.

Three tray ends, 3 inches high, 1 foot 8¼ inches wide.

Two shelves, each 1 foot 8¼ inches wide, 1 foot 10 inches deep. Ordinary 3/16 inch three-ply.

Three tray bottoms, 1 foot 8¼ inches wide, 1 foot 9 inches deep.

Three drawer bottoms, each 1 foot 8¼ inches wide, 1 foot 8 ½ inches long.

Three drawer backs, 8¼ inches high, 5 inches high, 1⅞ inches high, and 1 foot 8 inches wide.

Divisions between the drawers (if required) two, each 1 foot 8¼ inches wide, 1 foot 8½ inches long, and three similar pieces between the trays.

Four pairs of 3 inch brass butts ½ inch wide, two cabinet bolts, one cabinet lock and key, two door handles, and three drawer knobs, one extending wardrobe rail, and a mirror frame 3 feet 6 inches deep and 1 foot 6 inches over the frame, complete the furnishing.

The first step in construction is to cut the plywood board to the correct dimensions, and to plane the edges perfectly smooth and square to the faces.

Next saw out the surplus material at the bottom of the side pieces to form the two legs, and clean up these edges; then at a distance of ¼ inch from the top of the side pieces plough a groove ¼ inch wide and ¼ inch deep, as shown in Fig. 3, and work a rebate across each end of the top piece.

Work a similar groove across the lower part of side pieces, and fit the bottom board in the same way.

In the middle of the length of the top and bottom boards, and on the inside faces thereof, work a groove across, ½ inch wide and ¼ inch deep, commencing from the back as shown in Fig. 4, and terminating it ½ inch from the front edge. Cut notches from the front corners of the centre division panel, and fit it into these grooves, thus forming a stopped housing joint. Now on the inner faces of the right-hand compartment mark out the positions for the battens or runners on which the drawers and trays are supported.

Some of them are shown in Fig. 5, and are hard wood strips ½ inch thick and 1 inch wide, and 1 foot 9½ inches long. The lowest runners come in the angle between the floor and the uprights, and are to be laid flat ways; the others are set edge upwards, as shown in Fig. 5, and all should be glued and screwed in position.

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The body is assembled by gluing the joints and clamping the parts together, and securing the joints wherever possible by a few panel pins, driven from the outside. The back is then fixed by gluing and with fine panel pins or cabinet pins. Then fit the runners in their place and glue and pin the two shelves in place on top of their bearers. If divisions between the drawers are required, they should be fitted to the underside of the bearers. The drawers are made in the usual way, as shown in Fig. 6, but note that the front is wider than the sides and ends, so that when the drawers are closed the top edge of the lower drawer closes immediately under the lower edge of the drawers above and completely hides the ends of the bearers.

This simplified form of construction is more adapted to the needs of the home worker, as only a simple dovetail is called for at the junction of the sides with the front piece, and the bottom is glued and pinned directly to the underside of the side and back members, and secured to the front piece, as shown in Fig. 6, with a simple triangular fillet. The back piece is, of course, housed into the side pieces about ½ inch from the end. The drawers should work easily between the runners, as shown sectionally in Fig. 5. The doors can then be prepared and hung, using either four hinges per door or the continuous type of piano hinge. The top and sides of the doors are decorated with a commercial moulding about ½ inch wide and ¼ inch thick, glued and pinned in place as shown in Fig. 7. This imparts a little relief to the structure, and looks well if painted in old gold color, when the body of the wardrobe is stained a warm reddish brown and dull polished.

A little decoration can be applied to the fronts of the doors, as indicated in Figs. 1 and 7, by outlining the design in dull black and filling the space between with old gold. The faces of the drawers and the whole of the interior are preferably stained a warm brown and matt finished, after which the handles, bolts, and wardrobe rail are screwed into place and the lock is fitted. Two small pieces of the ½ inch plywood are cut to shape and fitted in the lower front and back corners to complete the feet, and if desired a mirror is fitted to one of the doors, as shown in Fig. 2, by screwing the mirror frame directly to the inner face of the door.

A final touch up and polish completes a useful, inexpensive, and attractive wardrobe cupboard.

Raising the German Fleet

By H. W. SECOR

(*Continued from page* 497)

portion of the craft. Immediately the stern arose above water, exposing the bottom of the vessel.

THUS, after many months of preparation, and diligent labor, the huge hulk was refloated through the buoyancy obtained with carefully distributed compressed air. When the stern appeared above the surface, the confined air shifted from the bow to the stern so that the bow became the lower portion of the vessel. With the *Moltke* floating even in the up-side-down position, it was a comparatively easy matter to tow the wreck to the beach where it could be stranded. Despite storm, troublesome currents and treacherous tides, the work was carried on to a successful conclusion and the armored cruiser was grounded on the shore at Cave Island. The illustrations and photographs will serve to give one an idea of just how this work is carried out. The drawing on the previous page shows an experiment which can be done in order to show the buoyant force of compressed air.

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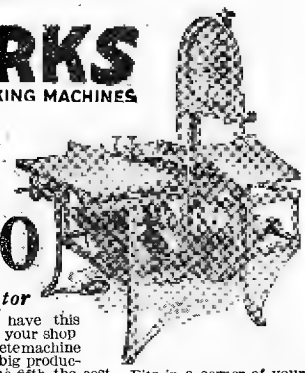

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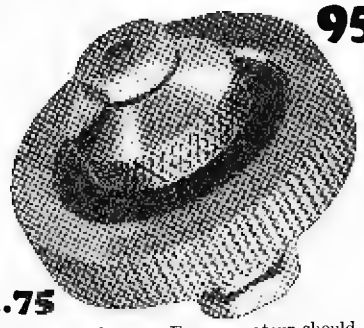

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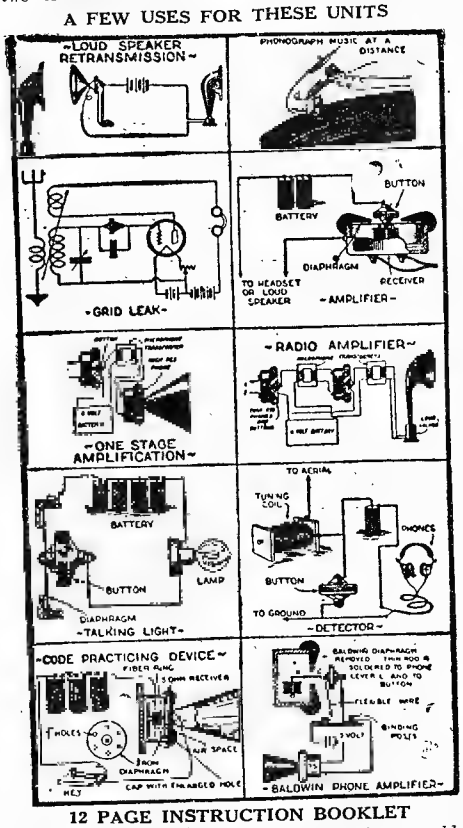

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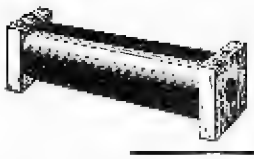

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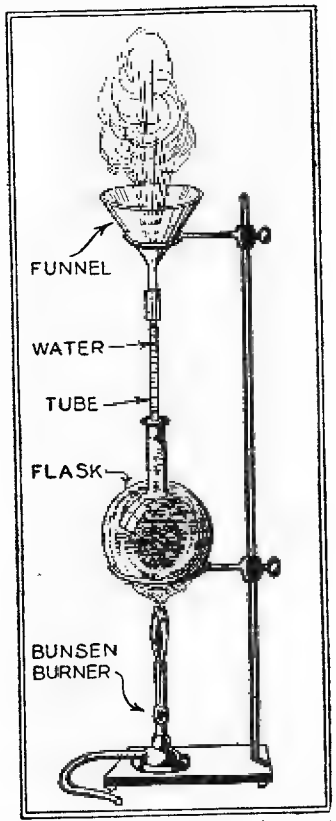
Geysers—Real and Artificial

By JOSEPH H. KRAUS

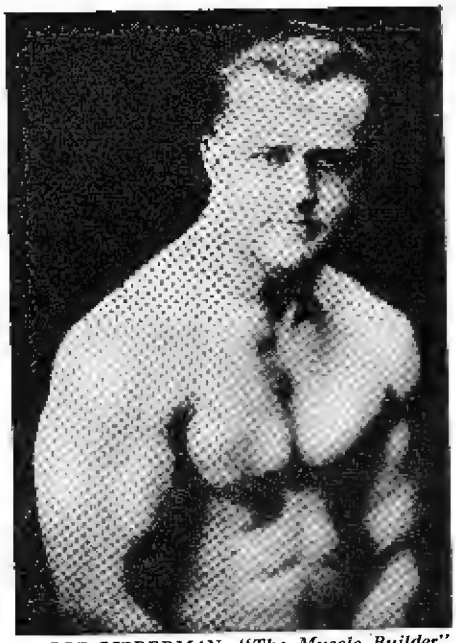
(*Continued from page 498*)

where there is a lower pressure. Here this quantity of water immediately becomes steam and rises rapidly, pushing the water above it, as explained before. This is always accompanied with a rumble and a roar.

Those interested in the laboratory production of a geyser will find the set-up of laboratory apparatus accompanying this article, capable of giving a fair duplication of this most interesting of nature's phenomena. An ordinary round bottom flask is fitted with a rubber stopper and a glass tube about 20 inches or more in length. The glass tube and flask are filled with water and the whole set up in a vertical position to boil. A funnel is also added to the top of the apparatus and secured to the tube by a short rubber nipple. When the water starts to boil, the entire apparatus will duplicate the action of a geyser. There will be periodical flashes of steam and hot water, which latter will be tossed upward as high as the ceiling. If the funnel is large enough, this water as it comes down, will be collected and redelivered by the tube. At the North Western University, Professor B. J. Spence built a 7-foot model of a geyser which the students called "Little Faithful." This geyser had a periodicity of from 10 to 15 minutes and shot a column of boiling water and steam nearly as high as the ceiling of the room. The operation was accompanied by a low rumble, highly suggestive of the rumble heard when "Old Faithful" emits. The tube of this 7-foot geyser is slightly conical, approximately 6 inches in diameter and 7 feet long. The lower end is closed and surrounding the upper end we find a huge circular pan, nearly 5 feet in diameter. This pan resembles a funnel. The tube is filled with water and is then heated at the lower end by several Bunsen burners, as the photograph shows.



The above illustration shows how a small geyser can be made in the laboratory. The experiment can be carried out simply with the aid of a funnel, a flask and a piece of tubing.



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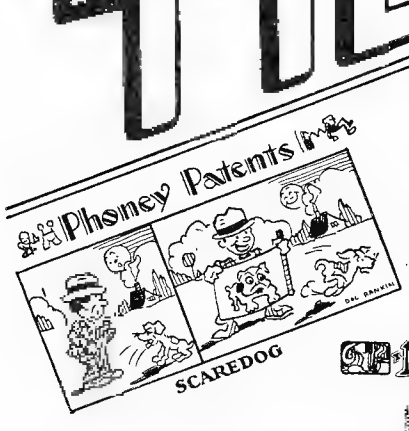

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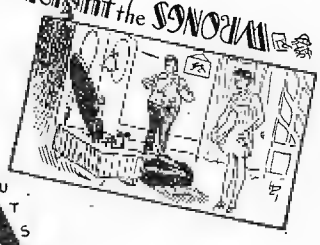

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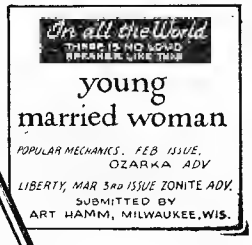
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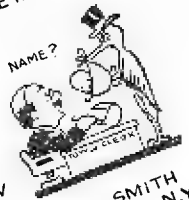

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The Secrets of Stage Juggling

By SAM BROWN

(*Continued from page* 491)

sweeping motion of the hand. By the use of these bolts, and sockets to match, the performer can weld the entire mass into a fairly stable unit on which he finds no difficulty in maintaining his equilibrium.

BALL ON CUE

OF the simpler faked juggling effects, the Ball on the Cue is a classic example. In this number, the performer causes a ball to run the length of a billiard cue and back again! It looks impossible. It is impossible! Only . . . the juggler's light ball runs down the thread track, as shown and the effect becomes simplicity itself.

Another juggling effect which makes use of the black thread is the Japanese Parasol. Here, the performer causes a ball to balance on the rim of an opened parasol while she rotates the highly-colored Japanese "umbrella" between her fingers. A light thread, attached to the ball makes the effect comparatively easy. This feat is also performed legitimately, but the majority of amateur and professional jugglers use the black thread method.

ONE HAND STAND

FREQUENTLY the juggler invades the domain of the acrobat, and includes in his program the difficult "one hand stand," as pictured. Of course, it's a trick. The candlestick is equipped with a sliding bolt which is shot up into a metal tube strapped to the performer's forearm, as shown. By the use of this contrivance, the performer can stand on one hand, or one finger.

SPINNING

In the category of "plate spinning" are many pretty effects which, although appearing quite difficult, are really comparatively easy. The majority of these "spinning" tricks depend on one very important item—the bottom of the article to be spun must be indented in some manner so as to furnish a stationary rest for the spinning stick. This is also illustrated. With the bottom shaped as shown, it becomes child's play to balance the rapidly revolving bowl on the end of a long stick. Many performers present the Spinning Bowl as a conjuring trick, as well, by filling the bowl entirely full of water and catching it empty at the conclusion of the performance. This effect is accomplished by a clever mechanical arrangement which allows the water to trickle through the bottom of the bowl into the hollow handle of the spinning-pole.

COUNTERWEIGHT TRICKS

Running a close second to the sliding bolt idea, the principle of the "counterweight" is responsible for quite a number of feats in juggling. One of these is the famous "hat tossing" act. Beyond a fair degree of skill in finding the mark, there is nothing exceptionally brilliant in the manipulation of the parabolic curving bonnets, for every hat is weighted. This weight is important. It keeps the hat constantly spinning on a fixed axis; and given that concession the inventive showman can evolve an act, which, in vaudeville parlance, is a "wow."

SPRINGING LEOPARD

A clever little conceit that is a little out of the beaten path in juggling feats is the Springing Leopards effect. It is usually used to close a program in perhaps the following way: The performer is startled by the odd motions of a skull which rests on a table upstage. He jumps back, throwing his hands overhead in simulated horror, and as he does so, two leopard skin rugs come to life and leap for the artiste.

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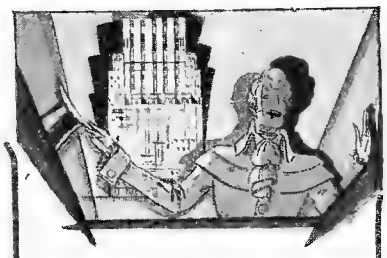

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Safety First in the Home

By RHYS G. THACKWELL

(*Continued from page* 493)

time the iron may burn your laundry and may start a fire and the child may pull it from the table and any number of unpleasant things might happen. The same precaution applies, of course, to the electric toaster and the grill and other electrical devices, including the curling iron, too. Overheated electrical appliances cause trouble.

Put away poisons where a person might not mistake them for something harmless. Many deaths have been caused by failure to get the right bottle in a bathroom cabinet. Label the poison, too, and keep it in a bottle that looks like skulls and cross-bones, too.

ELIMINATING ELECTRIC HAZARDS

THE United States Bureau of Standards advises that, while in bathrooms, toilet rooms, kitchens, laundries, basements and other places where there are damp floors, stoves, heaters, steam-radiators or pipes which may be touched, a person should avoid touching any metal part of a lamp socket, fixture or other electrical device, since it may accidentally be alive. When in a bathtub you should never touch any part of an electrical cord or fixture, even if it is a nonconductor, as a dangerous current might be set up through the human body.

When using a telephone, you should not touch stoves, radiators or other metal objects and particularly during electrical storms, else you may get a shock or be electrocuted.

If someone has been shocked by electricity, call aid at once and then use a long dry board or a wooden handled rake or a broom to draw the person away from the wire or the wire away from him. Do not touch the body while it is in contact with the wire, else you will get shocked, too. Never use metal or a moist object to draw away the wire or the person. Then, after separating the victim and the wire, try to revive him, as you would try to restore a drowned person.

Fires cause terrible tolls in lives and property in American homes annually. Have chimneys inspected. Keep them clean and in good condition. Sparks on roofs cause many fires. Are your house-tops of metal or wood, is a question worth consideration. Inflammable materials should not be left where they might be ignited by careless throwing of a match. A match should not be carelessly tossed aside, but should be put out before it is discarded and then it should not be chucked into a waste basket but into an ash tray or other safe place. Safety matches are better than ordinary ones for safety purposes, and any match should be struck when the box is closed so that there will not be danger of a flash starting the entire box of matches afire and perhaps causing disaster. Matches should be kept out of reach of children. That seems superfluous to tell to parents, but every now and then one reads about some tiny tot who gets the box of matches in absence of the folks and starts a nice bon fire in the kitchen or front yard and is rescued by neighbors or perhaps is not rescued and dies, a victim of lack of proper discipline.

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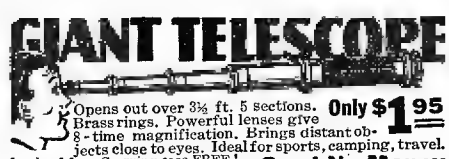

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A pile of oily rags can easily catch fire. They should be kept in a closed metal container. Garages should be fireproof. Gasoline supplies should be located where there is no or a reduced fire hazard.

Possible causes of home accidents should be studied in every home and the hazards should be reduced for the happiness and welfare of the home. Though 90 per cent of accidents are avoidable, according to the National Safety Council estimate, a Hartford, Conn., insurance company last year paid out almost $700,000 to about 6,000 persons who were victims of home accidents. More than a thousand of these were cut by sharp instruments or by broken glass. Almost one thousand fell on steps or floors in their homes. Almost 400 collided with inanimate objects. More than 300 were struck by falling objects. An even larger number fell on sidewalks or on the lawns of their homes. Handling, lifting or carrying heavy objects injured 248. Others were caught in doors or windows, bitten by insects, bumped into other persons, fell from chairs, fell getting in or out of bed, fell from ladders, from bathtubs, and over objects, were poisoned by shrubs in their gardens, stepped on broken glass or nails and almost 100 were hurt by hand tools.

Airport of New York City

By WILLIAM P. SULLIVAN

(*Continued from page* 512)

operations. The first and second floors will be occupied by all the field administration offices, airline headquarters, ticket offices and waiting rooms. The third and fourth floors will form the tower and contain all the control systems, radio communication and direction finding apparatus and weather bureau. All incoming and outgoing air traffic will be controlled from this tower.

Provisions are made for the construction of a hotel for the use of passengers arriving late at night or departing early in the morning.

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THE field and runways are to be illuminated at night by groups of flood lights, situated so as to illuminate as far as possible only the runways and surfaces to be used, depending on the direction of the wind. Boundary lights are to be placed 200 feet apart along the outside boundaries of all runways and areas. These lights are to be white except at the ends, where green lights will be shown to direct the pilot to the desired runway.

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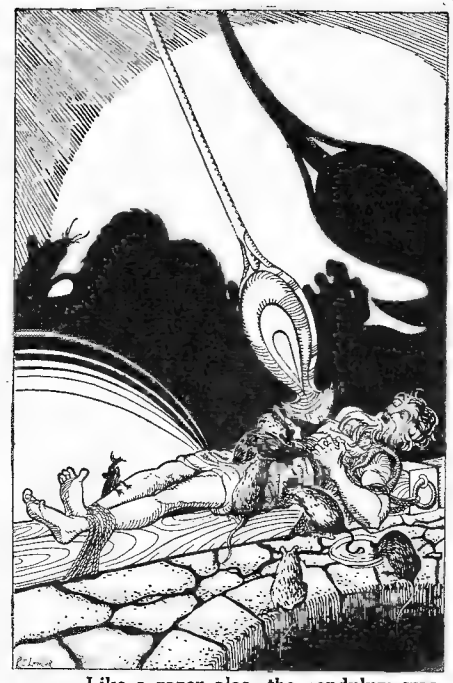

.....Like a razor also, the pendulum was massy and heavy, it was appended to a weighty rod of brass, and the whole *hissed* as it swung through the air. I saw that the crescent was designed to cross the region of the heart. Down—steadily down it crept. The rats were wild, bold, ravenous, their red eyes glaring upon me. And then.....

From "The Pit and the Pendulum."

***All Scientifiction Stories in list of contents are identified with a star and printed bold face.**

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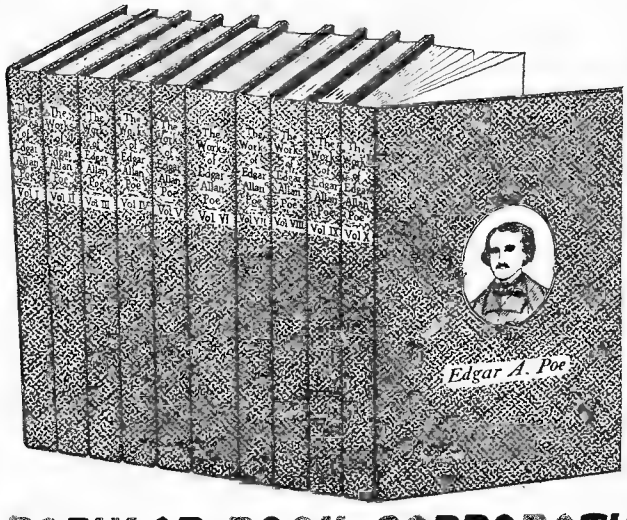

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Splicing and Editing the Home Movies

By DON BENNETT

(*Continued from page* 513)

at Baltimore to see some of the historical points, then you would run a title at the end of the Washington sequence something like this, "On the way home we stopped over in Baltimore just long enough to visit a few historic spots," followed by a title, "Fort McHenry" or "Fort McHenry—Inspiration for *'The Star Spangled Banner.'*" You will notice that although the introductory title in this case contains eighteen words, it conveys four thoughts. First is that the party left Washington, then they stopped at Baltimore, where the scenes to follow were taken. Next the title shows that the visit was short and last the purpose of the visit. The next title is descriptive of one of these points of interest and in the case of places like Fort McHenry, one can feel safe in leaving off its reason for being of historic interest, because every school child knows why it is honored. Less known points should have a full description, briefly worded, so that your audience will know what your picture is about."

All the time he had been talking Jones had been running through the films, cutting out bad spots and rearranging scenes in a more interesting manner. As he finished the film and handed it to Blake, the latter asked, "Where can I get these titles?"

"You can make them yourself or you can buy them from one of the title laboratories."

"Are they hard to make?"

"Not at all, if you want to drop in some day and spend an hour or so with me I'll give you quite a lot of dope on short cuts in title making."

(Meet Jones and Blake on this page next month and learn how to do trick work. Lots of interesting dope for the amateur movie fan.)

MOVIE QUESTION BOX

KEEPING FILM MOIST

Herbert Jones writes:

Q. Will you please tell me how I can keep movie film moist—or at least from becoming dry and brittle. Also how I can clean film that is marked up from running through the projector. I wipe the film track after each showing.

A. A humidor can, frequently moistened, will usually keep your films in excellent condition. In extreme cases a little gum camphor dissolved in carbon tetrachloride serves admirably. Scratches in the film cannot be removed but dirt can. Rewind the film through a rag saturated with tetrachloride and then wipe with a dry rag. Extreme pressure is not necessary but the pressure should be enough to remove dirt particles.

CLOUD FILTERS

Wm. Hibbs inquires:

Q. With panchromatic film, what filter should be used to bring out clouds, landscape and foliage?

A. A K-3 filter, which has an exposure factor of four and one-half, will give full correction of color. However a K-2 filter gives almost the same effect with less exposure and less chance of over-correction. A graduated filter will bring out the clouds and yet give full exposure to objects under the sky-line.

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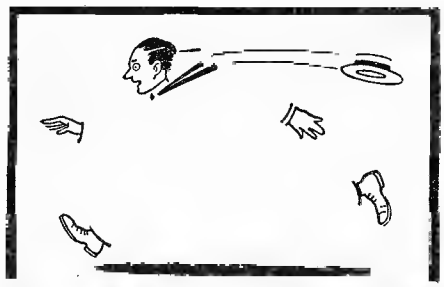

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Song Poem Writers—Send for proposition. Ray Hibbeler, D24, 2104 N. Keystone Ave., Chicago.

Song Poem Writers, Write Sequoia Songwriters' Service, Sherman Branch, Los Angeles, Calif.

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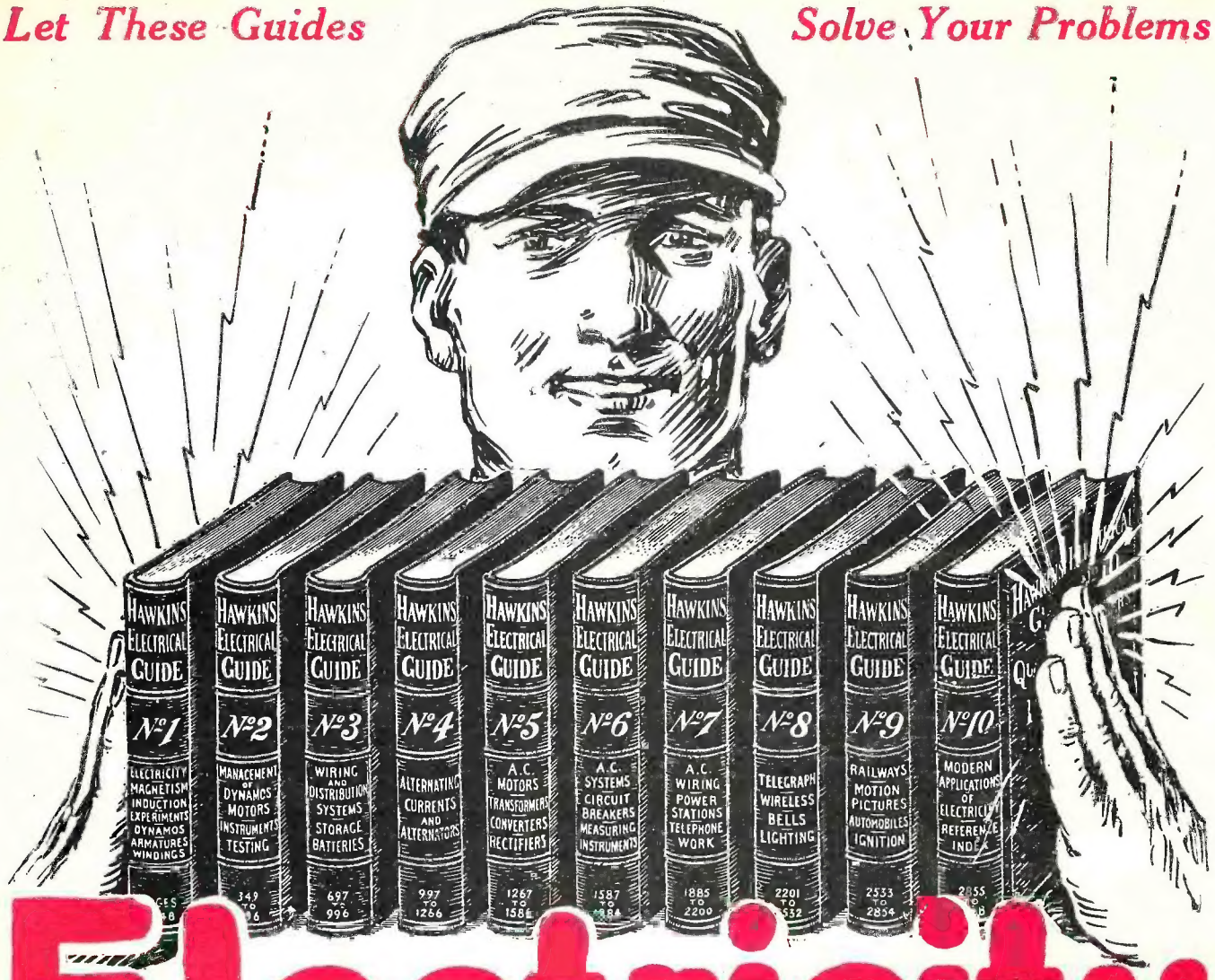

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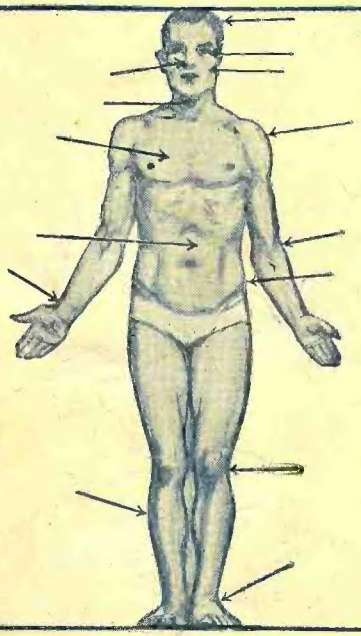

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